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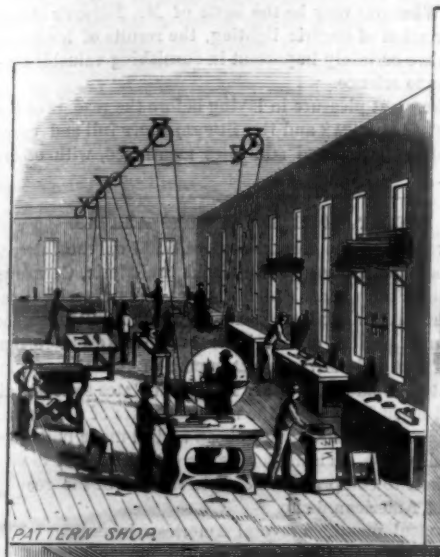
THE MANUFACTURE OF THE HARRIS-CORLISS ENGINE.

The details of the construction of the Harris-Corliss engine and the reports of its performances are already familiar to the readers of this journal; for this reason, and because the engine is now so widely and favorably known, it is unnecessary to repeat these items at length. It may be said, however, that this engine up to the present time maintains its superiority, and is to-day regarded as the standard engine.

Mr. William A. Harris, the proprietor of the Harris-Corliss Engine Works, at Providence, R. I., is now 44 years of age, and in the prime of life, an able mechanic and organizer. This, together with his twenty-four years' experience on the Corliss and Harris-Corliss engine, afford an explanation of the great success of this engine and of its enviable reputation. He commenced the business in a small way, and his facilities were limited to the construction of engines of from ten to twenty horse power. The business being very successful and demanding larger quarters, he built new engine works at the corner of Park and Promenade streets, having purchased two acres of land there.

On a recent visit to these works we were impressed with the system and order with which the work is done. Notwithstanding the great amount of labor in hand, the smallest and least important piece is as carefully dealt with as the ponderous castings of the larger engines. Special tools are adopted for a much wider range of work than is usual in establishments of this kind. The design of these tools, their adaptability to their work, the admirable organization of the establishment, together with the improvements which have brought this engine to perfection, are all due to the energy, tact, and talent of the proprietor of these works, and they place him prominent among the advanced mechanics of the day. When engineering ability of such high order is devoted to a single branch of manufacture, it is natural to expect higher results than are reached by those who engage in this, that, or the other—doing a great variety of work, but of poor quality. The works of Mr. Harris are devoted exclusively to the manufacture of his engine.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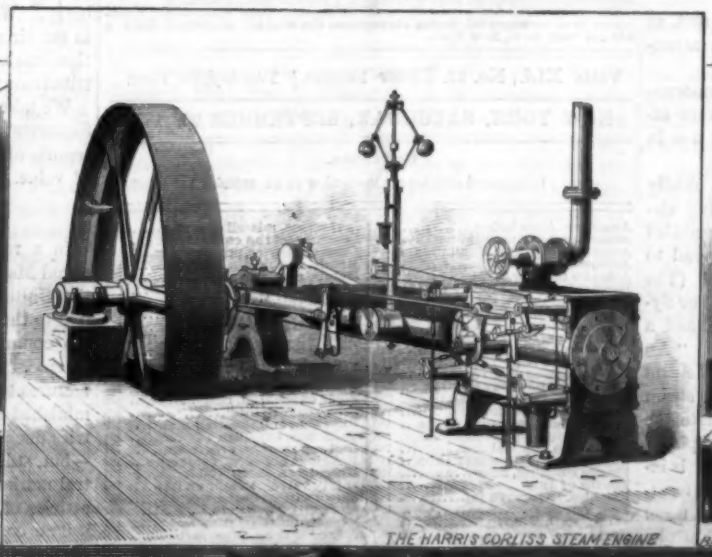
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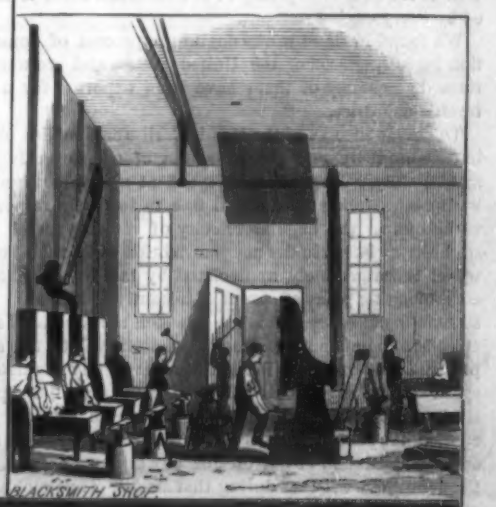
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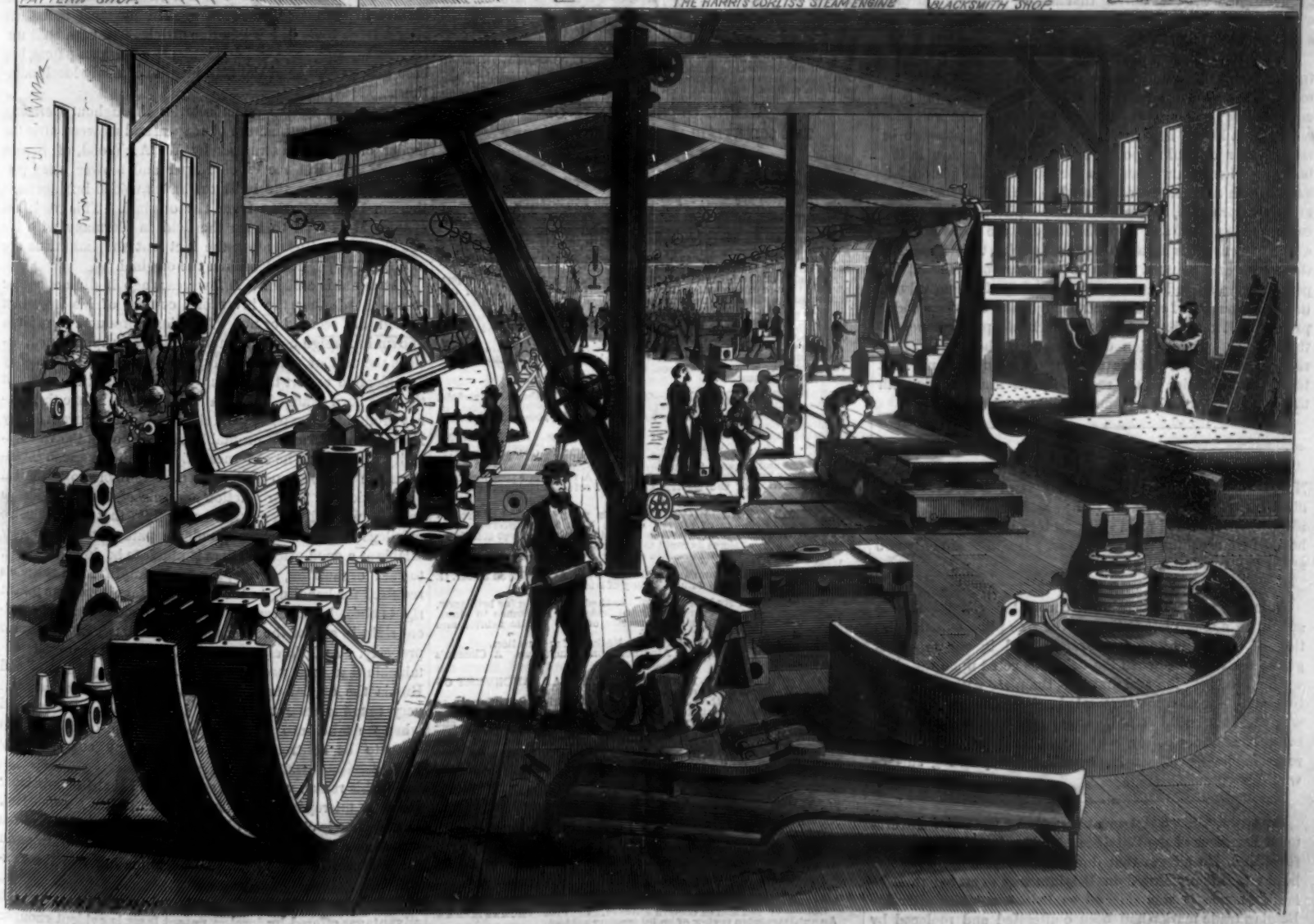

THE HARRIS-CORLISS ENGINE WORKS.

The new shop is located within six minutes' walk of the railroad depot and within ten minutes' walk of the business center of Providence. At these works there are facilities for manufacturing all sizes of engines, from ten horse power to one thousand horse power. The shop was arranged with reference to the handling of materials and parts of engines with the greatest facility. The lathes, planers, and other machines are placed so that, as the work progresses toward completion, it is moved over as little space as possible, in passing from one machine to another. This complete and careful arrangement of tools results in a great saving of labor and facilitates the work.

The demand for the Harris-Corliss engine is such that one thousand horse power per month in engines of different sizes have been shipped from this establishment for many months consecutively. It is now a common thing to contract for engines of seven hundred and eight hundred horse power, and furnish pulley fly wheels thirty feet in diameter, eight feet face, the wheel alone weighing, when finished, one hundred thousand pounds. These immense wheels are made in sections, fitted and bolted together. They are mounted on a shaft supported in suitable journals, and turned by applying to their spokes toothed segments and driving by means of a pinion.

A good idea of the appearance of the machine shop of this establishment may be had from the lower view in our large engraving on the front page. Here are shown the various parts of the engines and the means of handling them. In one of the upper views is shown the blacksmith shop, in the other the pattern shop.

The accuracy of the work done in this establishment, as well as the excellent quality of the materials used, is attested by every engine sent out.

We found in these works engines in process of construction for all portions of the United States, and we were informed that many of them have been exported for use in foreign countries.

The great success of the Harris-Corliss engine lies chiefly in the simplicity and precise action of the governing elements; the governor is an independent mechanism, saddled with no extraneous load, and free to instantly respond to variations in the angular velocity of rotating parts. (The slightest variation in the angular motion of the shaft or fly-wheel is immediately appreciated by the governor, and a corresponding point of cut-off is instantly indicated.) "An automatic cut-off engine is one in which the volume of steam cut off in the cylinder is exactly proportioned to the steam pressure and imposed load, to automatically regulate the speed of the engine. If the load is increased, the piston stroke to cut off is lengthened; if the steam pressure is increased, the piston stroke to cut off is shortened, and *vice versa*, and the regulation of cut off for any stroke depends upon the conditions existing during that stroke. Thus each stroke of the piston and each semi-revolution of the crank possesses a perfect autonomy."

In the Harris-Corliss engine, when the steam port is opened for admission of steam to the cylinder no obstruction exists to the free flow of steam from the boiler, and when the connecting pipe is of proper size, with few bends and well protected from loss of heat by radiation, the initial pressure in the cylinder is within a pound or two of the pressure in the boiler. When steam flows into the cylinder the piston advances with a velocity proportional to the load on the engine and steam pressure, the motion of the piston is communicated to the crank, and from the shaft to the governor, and a point of cut-off is indicated for that stroke; the nearness of the steam and exhaust valves to the bore of cylinder, the prompt opening and instantaneous closing of steam valves, the rapid opening of exhaust and the tightness of valves under pressure, all contribute to the remarkable performance of this engine. The motion of steam and exhaust valves derived from the wrist plate is peculiar to this engine, and, next to the precise action of the regulator, has much to do with the high economy of performance.

A Large Cog-Wheel.

A cog-wheel, said to be the largest ever made in Paterson, N. J., has lately been finished. It is of iron, 20 feet in diameter, the periphery 10 inches wide, and it weighs 12 tons. It is designed for a sugar factory in Cuba, and is to be used for crushing the sugar cane. It will make only two and a half revolutions per minute.

HUSNIK's plan for causing a chromated gelatine film to adhere to a zinc plate is to coat the zinc plate with a solution of three grammes of chromic acid in one thousand grammes of water; when the acid has acted upon the zinc, wash off the solution and first coat the plate with plain gelatine, and then with the chromated gelatine. Treated in this way the film is said to adhere very firmly to the zinc; but it must be kept dry before being used, otherwise a chemical reaction is apt to set in, by which the printing surface would be spotted.

AN extraordinary statement is made by the Chief Government Engineer of the Province of Liége in his trade report for 1878. He alleges that during last year a good deal of hardware manufactured in Belgium was exported to England, whence it was shipped to British colonies after the Belgian trade marks had been obliterated and replaced by spurious English ones. 1878 was the worst commercial year which Belgium has known since 1830.

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NEW YORK, SATURDAY, SEPTEMBER 20, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 194,
For the Week ending September 20, 1879.

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THE AMERICAN ASSOCIATION.

Notice has been taken in other columns of the general proceedings of the American Association at its Saratoga meeting. On the whole it was an enjoyable convention, well attended by members, and well supplied with papers, though no part of the proceedings may be described as of extraordinary interest or importance.

No great scientific discovery or invention, that the readers of the SCIENTIFIC AMERICAN would consider entirely novel, was brought before the meeting. The main results of Mr. Michelson's investigation of the velocity of light had already been made public. The details of his work, however, were known to but few, and his paper was justly regarded as of superior value and merit. Professor Marsh's address was a masterly review of a great subject, crammed with information which will give it permanent value. As a record of the bibliography of palæontology, as well as a history of the development of the science, the printed address has no equal in that field.

Major Powell's treatment of Mythologic Philosophy was not only intensely interesting and suggestive, but singularly original, and freighted with a wealth of information with regard to the mental conditions of American savages. No better evidence could be given of Major Powell's fitness for the great work he is engaged in under the auspices of the Smithsonian Institution.

Mr. Edison's researches in connection with the behavior of highly heated metals in vacuo are certainly promising; possibly they mark the opening up of a new department in the practical treatment of metals, as well as in scientific metallurgy. Whatever may be the issue of Mr. Edison's efforts in the direction of electric lighting, the results of his investigations are certainly important in furnishing valuable contributions to science.

We take great pleasure in laying before the readers of the SCIENTIFIC AMERICAN and the SUPPLEMENT full and exact reports of the papers and addresses mentioned, with others of value.

PATENT YOUR INVENTIONS ABROAD.

In a report to the Department of State on the International Machine Market recently held in Leipsic, Germany, the United States consul to that place calls especial attention to the national and personal loss which results from the too common neglect of our inventors to take out foreign patents. Not only is the direct export of American manufactures to Germany and other European states seriously diminished by such neglect—the manufacturers of those countries flooding the market with cheap and ill-made imitations—but, still worse, such imitations are often exported to neutral markets to compete with or ruin the sale of the genuine articles of American make.

The consul mentions several American inventions whose market in Germany has been spoiled by local imitations after a large trade in the genuine articles had been built up. He also instances one which, thanks to a German patent, has been able to command the field in spite of many local imitations. He says:

"There are twelve manufactories throughout Germany engaged in the manufacture of reapers and mowers, after the model of those constructed by W. A. Wood, of Seneca Falls, N. Y. But the Wood reaper and mower being patented in Germany, the imitators have avoided infringement thereon by a variation from the original. This variation enables Mr. Wood to keep the field in Germany with his machines, notwithstanding the fact that the imitations are offered at 40 per cent less than the original."

The moral is evident. A few years ago it did not matter so much whether the inventor's control of his invention abroad was secured or not. American products were little known in foreign countries and imperfectly appreciated; besides the cost of manufacturing here was so great that any considerable export trade was out of the question. But all that has been changed. Even if the article is one that cannot profitably be exported the right to manufacture it in any European state can be profitably disposed of in the vast majority of cases. The eagerness with which American inventions are snapped up by foreign makers liable to unlimited competition in the production and sale of them is evidence enough, were all other evidence lacking, that the exclusive privilege of manufacturing under a patent would be easily salable at a good price. There is much to be done, it is true, toward organizing, developing, and simplifying the means required for handling to the best advantage American patent rights abroad; but even now the possession of a good patent right in any of the leading European states is a valuable property. And foreign patents are much more easily obtainable than most people imagine. Excepting England and Russia the official fees for patents in Europe are now not very much greater than those in the United States; and when we take into consideration the value of the markets thus to be controlled, the costs become comparatively trifling.

For this reason we are forced to think that Commissioner Paine is misreported in a late dispatch to the *Evening Post*, in which he is charged with saying that American inventors quite generally prefer not to secure patents in Europe in consequence of the high and discriminating fees there exacted.

That American inventors do largely neglect to secure the advantages offered by foreign patent laws is evident enough; but it is not due, we think, to any deliberate balancing of cost and possible profit. More frequently the American in-

ventor utterly fails to appreciate the real value of foreign fields of operation. The opportunities offered at home are large enough to satisfy his ambition; and he does not know what he could do with foreign patents it he had them. The more enlightened of our inventors, however, are finding out the impolicy of such indifference to European markets; and before many years the neglect to take possession of them will form the exception and not the rule.

Our national redress, therefore, against the lawful appropriation of unpatented American inventions abroad, and the consequent loss to our national income, is rather through the enlightenment of our inventors by means of information such as the Leipsic consul sends, than through any attempt at retaliation by the exclusion of foreign inventors, as Commissioner Paine is reported as favoring. The *Post* writer says:

"The only practical measure of redress open to our government would be to adopt a scale of fees for foreigners to correspond with those charged to American inventors. This course, the commissioner thinks, would speadily bring about a desired change, as foreign inventors regard the American market as an exceptionally good one for mechanical devices, and are always anxious to take out American patents."

Possibly it might, but we should be the heaviest losers by the attempt. The expressed object of the American patent system is the advancement of the useful arts—the multiplication and perfection of American industries. To accomplish this end, inventions are encouraged by offering the inventor, for a term of years, the exclusive right to use, make, and sell his invention and its products. The nationality of the inventor has nothing to do with the matter. If his invention is new and useful we want the benefit of it; and we are more likely to reap that benefit by treating him fairly than by trying to exclude him or rob him. The circumstance that certain foreign governments do not show a corresponding willingness to accept the benefits offered them by American inventors is no excuse or reason for our imitating their unwisdom. The moment we look upon inventions in their proper light, as the bases of new industries and the improvement of old ones, all talk of retaliating against foreign shortsightedness in the matter of patent rights, by handicapping foreign inventors, is sheer nonsense. The best way to induce foreign governments to treat American inventors more liberally is to prove to them by our industrial progress the vital advantage of treating liberally all inventors, their own as well as ours.

Be that as it may, the fact remains that most European governments do now offer our inventors privileges that are worth securing, though at a somewhat higher cost than we are accustomed to here, and every year those privileges increase, and rapidly increase in money value.

GELATINE NEGATIVES.

Much success has of late attended the production of photographic negatives in which a substratum of gelatine is used as the vehicle to carry the sensitive silver instead of collodion. It was claimed, among other advantages, that the gelatine was cheaper than the collodion. It seems now to have been ascertained in England that for the damp climate of that country, at least, the gelatine negatives are unstable.

The film expands and contracts, under the varying degrees of atmospheric moisture, to such an extent that the usual varnish soon cracks and the surface is covered with a fine powder, while the surface of the gelatine retains the markings of the cracks, and the negative is spoiled. To prevent this loss of negatives, it is recommended that gelatine negatives be covered with a film of collodion and then varnished. The collodion has a greater expansive quality than the varnish, and does not crack. It perfectly preserves the gelatine negative. But inasmuch as collodion makes first-rate negatives, would it not be better to omit the gelatine altogether?

In the meantime we will suggest that the latest improvement in the production of gelatine plates—formulæ for which we have heretofore published—consists in adding a quarter of a grain of gelatine to the solution of bromide employed in precipitating the silver. This simple little change gives ease and certainty to the production of dry gelatine plates of the highest sensitiveness. This improvement confirms the suggestion of M. De Pitteurs, that the remarkable sensitiveness of gelatine plates is due to a chemical combination between the gelatine and silver which favors the action of light on the bromide of silver.

THE DISSOCIATION OF CHLORINE.

Employing the improved method of determining vapor densities, which he introduced last year, Professor V. Meyer, of Zurich, has lately subjected chlorine to a series of tests which strongly indicate a compound character for that hitherto supposed element. As described in *Nature*, the apparatus employed is also extremely simple, and consists of a cylindrical bulb of about 100 c.c. capacity, sealed to which is a glass tube about 6 mm. in diameter, and 600 mm. long; this tube is widened out at the open end, so as to admit of the introduction of a caoutchouc stopper, and has a side tube, 1 mm. in diameter and 140 mm. long, sealed on to it about 100 mm. below the open end. The side tube is once bent nearly at right angles and the end slightly turned up, so that, when dipped into water, it will deliver gas into a graduated glass vessel inverted over it. For determinations at high temperatures the bulb is constructed of porcelain and is heated in a gas furnace; when operating at lower temperatures the bulb is heated either by means of a vapor bath or in a bath of molten lead. The operation consists in heating the bulb until it acquires a constant temperature, which is indicated by the non-appearance of air bubbles at the orifice of the side tube which is plunged under water; the stopper is then removed, the weighed quantity of substance introduced and allowed to fall into the bulb, the stopper quickly reinserted, and the end of the side tube then brought under the measuring vessel; directly air ceases to issue from the extremity of the tube, the stopper is removed, and the air thus collected is afterward measured in the usual manner. In the case of substances which undergo oxidation when heated in air, the air is first displaced from the apparatus by a current of pure nitrogen. In this manner the volume of vapor, measured at the atmospheric temperature and pressure, generated by a known weight of substance, is ascertained, and the density deduced from these data by a simple calculation.

Experimenting with chlorine the numbers obtained at a temperature about 620° C. agreed with those required on the assumption that the chlorine molecule has the formula Cl_2, which is that generally accepted. At higher temperatures, however, a diminishing density was determined, until at about 1,200° and above, the density was two thirds that obtained at 600°. In this respect the action of chlorine, when heated, is precisely like that of oxygen when passing from the condition of ozone to its ordinary condition. Two explanations are possible. Either what is regarded as the atom of chlorine is (like ozone) a compound of three subatoms, with the formula Cl_3 (instead of Cl_2 as commonly held), or chlorine is not an element, but a compound of at least two elements which are dissociated by heat.

In confirmation of the correctness of the latter supposition, there comes the report from Zurich, printed in the *Chemical News*, that Professor Meyer, in conjunction with Herr C. Meyer, has determined that in all probability oxygen is one of the components of chlorine. Still further, an unconfirmed report has reached *Nature* to the effect that the Messrs. Meyer have actually separated oxygen from chlorine. Should these reports be confirmed, the chemistry of the non-metals will enter at once upon a new era. In the communication to the Berlin Chemical Society, describing the experiments noted, the Messrs. Meyer state that bromine behaves like chlorine; and if chlorine has been dissociated, the rest of the group are likely soon to follow.

THE NORTHWEST PASSAGE SUCCESSFULLY MADE.

The Swedish exploring steamer, Vega, of the Nordenskjöld expedition, arrived at Yokohama, Japan, Sept 2. The Vega was in excellent condition; all on board were well, and there had been no sickness or scurvy on board during the long Arctic winter.

The following report of the entire voyage, as told by Professor Nordenskjöld, was telegraphed to the New York *Herald*. The Professor says:

"We sailed from Gothenburg on July 4, 1878, and a four days' sail brought us to Tromsöe (a Norwegian port on an island of the same name), where our outfit of furs and necessaries for the high latitudes was completed. Here we were joined by the companion steamer, the Lena. On July 25 both vessels sailed from Tromsöe, passed through the Yugor Strait (south of Nova Zembla) on August 5. There was not a particle of ice to be seen between the Waigatsch (Vaigatza, a Russian island) and the continent. The Kara Sea, hitherto dreaded by all sailors in the Arctic regions, was equally free from ice, and anchor was cast at Port Dickson, near the mouth of the Yenisei, on August 6.

STEERING NORTHEAST.

"After a three days' delay there the two steamers of our expedition steered northeast toward the dreaded Taimur land and the North Cape. The ice arrested our passage and we were compelled to remain at Tajoyr (Cape Taimur?) four days. On August 19, Tsejdekin, the extreme northern point of Asia, was reached, where a short rest was taken. The Vega coasted the peninsula, very little ice being encountered, and anchored at the mouth of the Lena River on August 26. To the northeastward were the islands of New Siberia, which we soon sighted, but were unable to explore because of the great field of ice that girt their shores. The mouth of the Kolwya River (latitude 69 deg. 30 min., longitude 161 deg. 30 min.), a broad estuary, was found open, and we hastened to make all possible progress eastward. Our difficulties soon began, however, and increased daily. We were delayed much with the ice between Cape Cook and Van Karema. We crossed Kolintschm Bay on September 27 with comparative ease, but were imprisoned on the 28th near a Tchuktchi settlement (latitude 67 deg. 7 min. north, longitude 177 deg. 24 min. west).

THE WINTER IN THE ICE.

"We wintered in the pack ice at this point, one mile from land. The entire ship's company maintained the best of health and spirits. Not a single case of scurvy occurred on board. During the shortest day the sun was above the horizon less than three hours, and then only the upper limb was visible. At this point much time was devoted to interesting scientific and ethnographic studies. There were 4,000 inhabitants in the several villages near by, who subsisted by fishing and sealing. They are called the Tchuktchi, and are a very agreeable class of people for an exploring party to meet. They supplied the expedition with bear and reindeer meat. The cold was intense, averaging 36 centigrade (82.2 degrees below Fahrenheit.) The game was abundant in the spring, wild fowl being taken in large numbers. We were detained in the ice at this point 264 days, but were released on July 18, and passed East Cape into Behring Straits on the 20th. Such is the story of our voyage.

COMPLETE SUCCESS.

"I fully accomplished the object for which the expedition was sent out by Dr. Dickson—namely, a practical proof of the existence of a Northeast passage. Then the Asiatic coast was followed and St. Lawrence Bay was crossed to Port Clarence, Alaska. Thence we crossed to Koniyan, dredging carefully in order to determine the formation of the bottom of the sea, many specimens of the fauna and flora being obtained. The location, breadth, velocity, and approximate volume of the currents of the Arctic and Pacific Polar currents were charted and calculated. Having touched at St. Lawrence Island we next proceeded to Behring Island, where we received the first news from Europe through the resident agent of the Alaska Trading Company. The fossil remains on Behring Island are of immense variety. A new marine animal was here discovered, which we named *Rhytina stellari*. The Vega left the island on August 19, and had a pleasant voyage until August 31, when a severe gale was encountered, accompanied with lightning. During the storm the lightning struck and shivered the maintopmast, slightly injuring several men. We arrived off Yokohama at half past eight on the evening of September 2. All are well, and no deaths have occurred during the voyage.

PROSPECT.

"The Vega is the first vessel to make the passage, and I think the voyage from Europe to Asia by Behring Strait is certain and safe, with very little more experience of navigation in the Northern seas. From Japan to the mouth of the Lena River there are no difficulties in the proper season for experienced sailors. The Lena River taps Central Siberia, and a large prospective trade can readily be developed.'

Apart from the obvious commercial advantages to result from the outlet to Siberian trade, opened up by this plucky and successful voyage of the Vega, and the contribution to science made thereby, it is impossible as yet to estimate the probable good results of the expedition. If, as Professor Nordenskjöld believes, a safe and easy Northeast passage is demonstrated, its availability must be confined to two or three summer months at best—too brief a period for an established commercial route; and vessels which take the southern routes during ten months of the year, are not likely to venture into icy waters for a single trip, however much it may promise to save in distance. With good luck the northern voyage, say from England to Japan, might possibly be made in half the time now required, but instead of having open sea room for the most part, the trip would be mainly along a dangerous and inhospitable coast in a narrow channel between ice fields and foggy shores, with the ever imminent risk that northerly winds might at any time bar the passage with Arctic ice floes, and imprison the ship for an Arctic winter.

Under improbably favorable conditions the Northeast passage may prove a useful route between Western Europe and our Pacific coast; but it will require more than one successful passage—a two seasons' trip at that—to induce many shipmasters to go that way.

PLATINUM IN THE UNITED STATES.

Notice was taken some time since of Mr. Edison's circular letter of inquiry with regard to the possible occurrence of platinum in various parts of the country. Mr. Edison informs us that, so far, he has received some three thousand replies. Instead of being an extremely rare metal, as hitherto supposed, platinum proves to be widely distributed, and to occur in considerable abundance.

Before Mr. Edison took the matter in hand platinum had been found in the United States in but two or three places—in California and in North Carolina—and in these places it occurred but sparingly. It is now found in Idaho, Dakota, Washington Territory, Oregon, California, Colorado, Arizona, New Mexico, and also in British Columbia.

It is found where gold occurs, and is a frequent residual of gold mining, especially placer mining. Mr. Edison thinks he can get 3,000 lb. a year from Chinese miners in one locality. One gravel heap is mentioned from which a million ounces of platinum are expected. Hitherto the product of the entire world would not suffice to supply electric lamps for New York city. Now Mr. Edison believes that our gold mines will supply more than will be required. The possible uses of this metal in the arts, however, are so numerous that there is no danger of an oversupply.

In addition to platinum Mr. Edison finds, among the large number of samples received daily, many other valuable metals and minerals, so that his researches in this direction are likely to result in increasing greatly the resources of our country in respect to the rarer and more costly minerals and metals.

THE *Insurance World* thinks our present complicated system of fire alarm telegraph should be substituted by the much more desirable system of telephonic communication. The advantages, like an axiom, are so self-evident as not to admit of any elaborate demonstration. One of the special features is that it will enable the person sending in the alarm to affix the exact location of the fire, and thus obviate the necessity of the firemen hunting for the exact point in the district at which their services are needed.

Bog Oak Ornaments.

A gentleman, connected with the manufacture of ornaments from Irish bog oak, gives to *Land and Water* some interesting particulars with regard to the history of that industry. When taken up this bog oak is perfectly black from the action of the peat or bog water. It is very rarely obtained in a sound state, and in most cases the outer portions of the tree or log are rotted, and useless even for fuel. When laid up for use, care must be taken that it is not placed in the open air, lest it may, from the sun's rays, become open and shattered into chips from end to end. To preserve it, it must be put into some cool place, and left to dry gradually, and when properly seasoned it must be cut in lengths of from two to four feet, and these lengths be split again, and the sound parts removed from the unsound.

It takes from four to six years to season some specimens, as in many instances the wood is found at a depth of eight and sometimes ten feet under the surface. When properly seasoned, any portion requiring to be glued becomes hard as stone, and is firmer and less liable to give way than any portion of the manufactured article. The finish is not quite perfect until the article has been for some time in use, and the longer, the finer the article seems to be, no matter whether used as a personal or table ornament. The men employed are all, without exception, self-taught; each one makes his own tools, and will not take any apprentices; and each person has a peculiar taste for a certain class of ornaments, which he follows, and to which he is left to produce the best specimens he can. There are also jewelers who mount and embellish the ornaments with gold and silver, and with rare and most brilliant Irish gems, such as the Kerry Irish diamond, the emerald, the garnet, amethyst, beryl, aquamarine, and Donegal pebble. The Celtic ornaments are generally studded with the above native gems; they are beautiful, and most artistically executed. The designs embrace some thousands, and all of them are both classic and historically illustrative of Irish antiquities. Extensive deposits of bog oak and other buried woods have been discovered in Germany.

Lesseps and the Canal.

M. De Lesseps would have made a good actor if he had not been a successful engineer. He has been making a tour of France, visiting the commercial cities and lecturing on his new scheme of the Panama Canal. He carries with him his little daughter Totoitte, and she goes to the public meetings at which her father speaks. When she becomes drowsy, M. De Lesseps points to her and says: "That little girl will fire the first mine when we come to quarry the canal." Then Mlle. Totoitte awakes, and the crowd enthusiastically cheers.

SKIMMING MILK BY CENTRIFUGAL ACTION.

One of the results of modern systems of dealing with agricultural produce has been the growth in most civilized countries of large establishments for carrying out dairy operations in a wholesale way, such establishments being really manufactories in which mechanical appliances can be largely and profitably used to assist or replace hand labor. Among the operations to be performed in connection with such dairies, the skimming of milk occupies no unimportant place, yet until comparatively recently no efficient means of accelerating the ordinary mode of separating the milk from the cream had been perfected. As is well known, the mixture of the milk and cream is a purely mechanical one, the lighter fatty particles of the cream being as it were entangled in those of the milk, and separating from the latter by the action of gravity if the mixture is allowed to remain undisturbed for a sufficient length of time.

Experience has shown that the separation of the cream and milk is facilitated by maintaining the latter at a low temperature; but even under the most favorable circumstances the natural separation of the two substances is a slow operation. The shortest time, in fact, in which the separation has ever been thoroughly produced—so long as the ordinary action of gravity is relied upon to effect the operation—is, we believe, about twelve hours, the milk in this case being treated on Mr. Senwartz's plan, and kept at a constant temperature of about 50° Fah. by means of ice. According to the mode of procedure usually followed in this country and in Europe, the separation of the milk and cream occupies from 24 to 96 hours, the result being that in some cases the milk will not stand the period of exposure required to effect the thorough separation of the cream.

Under these circumstances, the idea some years ago occurred of intensifying the action of gravity by employing centrifugal force, and thus effecting the separation of the milk and cream more promptly. So far as we are aware, the first suggestion of this kind was made by Professor C. F. Fuchs, of Carlsbad, who, in 1859, proposed to employ centrifugal force to prove the amount of cream in milk, while in 1864 Mr. Brandtl, a brewer of Munich, applied centrifugal force to the skimming of milk on a large scale. The results of his experiments, however, were not published.

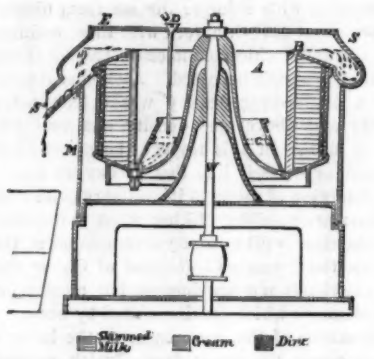


FIG. 2.—CENTRIFUGAL MILK-SKIMMING MACHINE.

Later on, Messrs. Lefeldt and Leutsch, engineers of Schöeningen (Germany), produced a practical machine for skimming milk by centrifugal action. This machine was recently patented in this country through the Scientific American Patent Agency.

Our engravings represent the machine as made by Mr. F. Wannieck, of Brünn, Austria. A is the drum of a centrifugal machine containing the milk to be treated, this drum being provided with a couple of internal paddles which insure the milk being carried round at the same speed as the drum. At the top the drum is partially closed by the cover, B, while within is a conical diaphragm, C, which reaches nearly to the bottom of the drum, as shown. A funnel, D, dips into the drum within the conical diaphragm, this funnel being supported by the cover, E, which does revolve, it being carried by the external casing, M, of the machine.

The vertical shaft of the drum runs in two bearings, as shown by the section, Fig. 2. It will be seen that the external case carries at its top an annular trough, S, this trough being furnished at one side with a discharge spout, S'. The revolving drum is furnished at the bottom with discharge cocks, T'. The mode of driving the drum will be readily understood from the engraving. The base of the machine is connected to a couple of pieces of timber which carry the standards for supporting a short horizontal countershaft provided with fast and loose pulleys, and a larger pulley from which a twisted belt is led off to the pulley on the vertical shaft of the revolving drum. The speed given to the latter is 1,000 revolutions per minute, and the belt driving it passes under a tightening pulley adjusted by the lever shown, this tightening pulley enabling the drum to be started gradually. A light belt on the vertical shaft of the drum gives motion to a revolution counter as shown.

The mode of using the apparatus is as follows: The drum having been charged with milk is set in motion, and as the speed increases the milk rises at the sides of the drum, and eventually assumes the position indicated in Fig. 2. In this position the particles of the milk will evidently, under the influence of the centrifugal force to which they are subjected, have a tendency to arrange themselves in layers in the order of their specific gravity, the heavier particles moving outward, while the light or fatty particles collect on the inner surface of the liquid column. The action of the centrifugal force being much more energetic than the ordinary action of gravity, this separation of the different particles of milk takes place very much more rapidly than when milk is allowed to stand in the usual way, and after the drum has been running at from 800 to 1,000 revolutions per minute for from 25 to 30 minutes, the cream is found to have collected on the inner surface, as indicated in Fig. 2, while all dirt in the milk has been thrown outward against the side of the revolving drum

The next operation is to remove from the revolving drum the cream thus collected. This is effected as follows: It will be noticed that the amount of the charge of milk is such that when it is, by the action of the centrifugal force, thrown into the form of an annular column, the inner circumference of the column is just level with the inner circumference of the partial cover, B, of the drum. To remove the cream some milk—generally skim milk—is poured down the funnel, D, and falling within the conical diaphragm, C, passes under the lower edge of the latter, as indicated in Fig. 2. The milk so introduced passes into the charge without disturbing the layer of cream, and the latter being displaced inward, flows over the inner edge of the annular cover, B, and escapes into the trough, S, from which it is discharged into suitable vessels through the spout, S'. The cream having been thus collected, the machine is stopped, and the skimmed milk run off through the cock, T.

With two machines containing 11 gallons each, 250 gallons of milk can be effectively skimmed in a day of ten hours, while the operation requires no skilled labor and but very ordinary care. Owing to the short time required, also, all chance of the milk turning sour is avoided, and the butter made from the cream is considered of first rate quality. Another advantage of this system, which was not at first counted upon, lies in its thoroughly separating from the milk all dirt which may have become mixed with it either during the process of milking or subsequently. This dirt, which collects as indicated in Fig. 2, smells badly, and an astonishing amount of it is separated by the centrifugal action even from milk which has been carefully filtered through hair cloth, thus showing that the hair cloth filters usually relied upon are far from being thoroughly efficient.

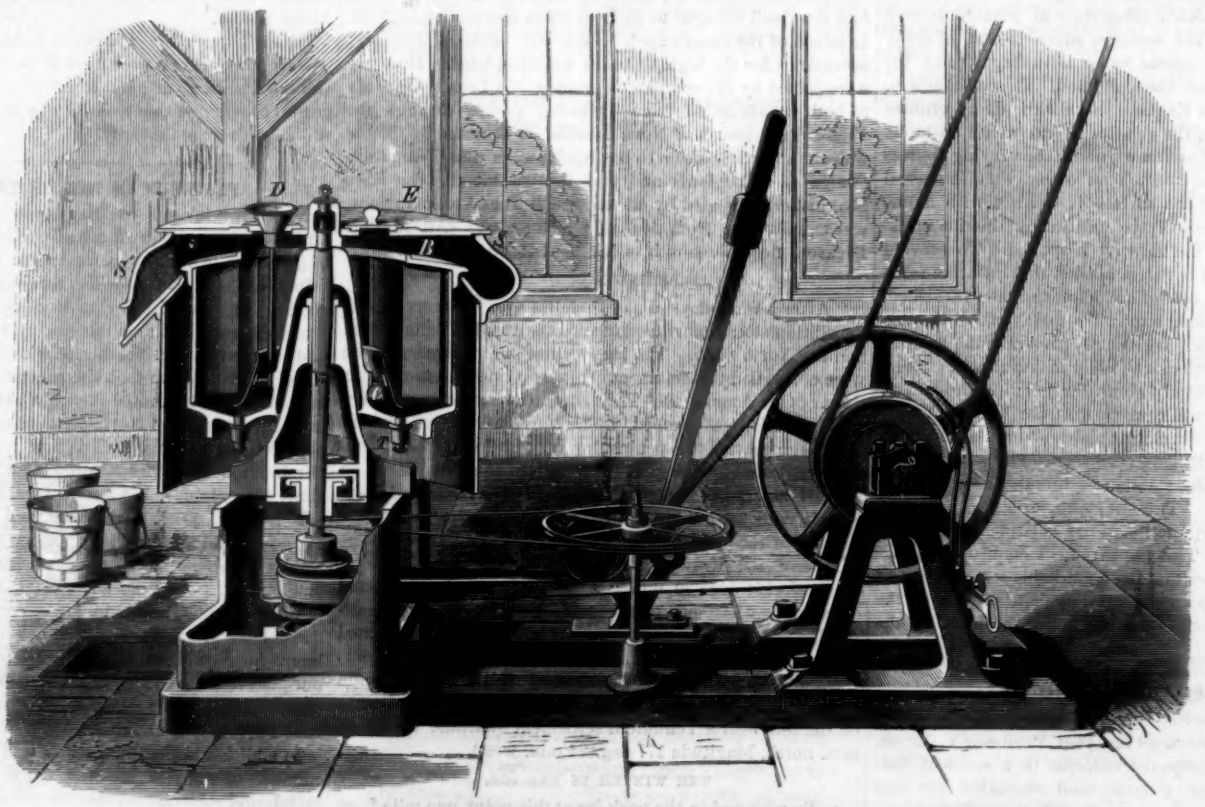


FIG. 1.—LEFELDT AND LEUTSCH'S CENTRIFUGAL MILK-SKIMMING MACHINE.

Spontaneous Ignition.

E. Bing, of Riga, Switzerland, has experimented with different materials: wadding, raw flax, hemp, the waste from silk, wool, and cotton spinnings, as well as sponge, and finally wood dust as found in any cabinetmaker's shop. They were saturated with various fluids, namely, oils, fresh and in a gummy state; turpentine, petroleum, various varnishes, etc. All the fibrous materials took fire when saturated with any of these oils or with mixtures of the same. Sponge and wood dust, on the contrary, proved to be entirely harmless.

Combustion ensues, with 17 grains of wadding and 67 grains of a strong oil varnish, in thirty-four minutes; while 200 grains of washed cotton waste, of which a portion was saturated with 750 grains of strong oil varnish, and the remainder wrapped about it, required almost fourteen hours. These materials were placed in a well sheltered spot, and subjected to a heat of from 40° to 65° Fah. Silk did not flame up, but slowly charred.

Disinfectants and How to Use Them.

The National Board of Health, consisting of a number of our leading physicians and chemical experts, of which Prof. C. F. Chandler is chairman, have issued the following instructions for disinfection, intended especially for the guidance of physicians and nurses in the yellow fever districts, but which are equally applicable in other classes of contagious diseases. In submitting this report the chairman says:

It has been the aim of the committee to prepare concise directions for disinfection, so simple and clear that they may be easily followed by any person of intelligence.

In the selection of disinfecting agents the aim has been: 1st, to secure agents which can be relied upon to accomplish the work; 2d, which can be procured in a state of comparative purity in every village in the United States; 3d, so cheap that they can be used in adequate quantities.

It is extremely important that the people should be instructed with regard to disinfection. They must be taught that no reliance can be placed on disinfectants simply because they smell of chlorine or carbolic acid, or possess the color of permanganate, and that, in general, proprietary disinfectants with high-sounding names are practically worthless, as they either have no value whatever, or, if of value, cost many times as much as they are worth, and cannot be used in sufficient quantity.

EXPLANATIONS.

Disinfection is the destruction of the poisons of infectious and contagious diseases.

Deodorizers, or substances which destroy smells, are not necessarily disinfectants, and disinfectants do not necessarily have an odor.

Disinfection cannot compensate for want of cleanliness or of ventilation.

I.—DISINFECTANTS TO BE EMPLOYED.

1. Roll sulphur (brimstone) for fumigation.

2. Sulphate of iron (copperas) dissolved in water in the proportion of one and a half pounds to the gallon; for soil, sewers, etc.

3. Sulphate of zinc and common salt, dissolved together in water in the proportions of four ounces sulphate and two ounces salt to the gallon; for clothing, bed linen, etc.

NOTE.—Carbolic acid is not included in the above list for the following reasons: It is very difficult to determine the quality of the commercial article, and the purchaser can never be certain of securing it of proper strength; it is expensive, when of good quality, and experience has shown that it must be employed in comparatively large quantities to be of any use; it is liable by its strong odor to give a false sense of security.

II.—HOW TO USE DISINFECTANTS.

1. *In the Sick-Room.*—The most available agents are fresh air and cleanliness. The clothing, towels, bed linen, etc., should at once, on removal from the patient, be placed in a pail or tub of the zinc solution, boiling hot if possible, before removal from the room.

All discharges should either be received in vessels containing copperas solution, or, when this is impracticable, should be immediately covered with copperas solution. All vessels used about the patient should be cleansed with the same solution.

Unnecessary furniture—especially that which is stuffed—carpets, and hangings, when possible, should be removed from the room at the outset; otherwise, they should remain for subsequent fumigation and treatment,

2. *Fumigation* with sulphur is the only practicable method for disinfecting the house. For this purpose the rooms to be disinfected must be vacated. Heavy clothing, blankets, bedding, and other articles which cannot be treated with zinc solution, should be opened and exposed during fumigation, as directed below. Close the rooms as tightly as possible, place the silver in iron pans supported upon bricks, set it on fire by hot coals or with the aid of a spoonful of alcohol, and allow the room to remain closed for twenty-four hours. For a room about ten feet square, at least two pounds of sulphur should be used; for larger rooms, proportionally increased quantities.

3. *Premises.*—Cellars, yards, stables, gutters, privies, cesspools, water closets, drains, sewers, etc., should be frequently and liberally treated with copperas solution. The copperas solution is easily prepared by hanging a basket containing about sixty pounds of copperas in a barrel of water.

4. *Body and Bed Clothing, etc.*—It is *best* to burn all articles which have been in contact with persons sick with contagious or infectious diseases. Articles too valuable to be destroyed should be treated as follows:

a. Cotton, linen, flannels, blankets, etc., should be treated with the boiling hot zinc solution, introducing piece by piece, securing thorough wetting, and boiling for at least half an hour.

b. Heavy woolen clothing, silks, furs, stuffed bed covers, beds, and other articles which cannot be treated with the zinc solution, should be hung in the room during fumigation, pockets being turned inside out, and the whole garment thoroughly exposed. Afterward they should be hung in the open air, beaten, and shaken. Pillows, beds, stuffed mattresses, upholstered furniture, etc., should be cut open, the contents spread out and thoroughly fumigated. Carpets are best fumigated on the floor, but should afterward be removed to the open air and thoroughly beaten.

5. *The corpses* should be thoroughly washed with a zinc solution of double strength, then wrapped in a sheet wet with the zinc solution, and buried at once. Metallic, metal-lined, or air-tight coffins should be used when possible, certainly when the body is to be transported for any considerable distance.

A NEW PUNCHING AND SHEARING PRESS.

In our last issue we gave a brief description of a press somewhat larger and heavier than that represented by the accompanying engraving. The working principle is the same in both, the power being obtained by the swing of a weighted pendulum at the back of the machine in combination with a shaft, automatic clutch, and slide.

"PEERLESS" PUNCH AND SHEAR PRESS No. 2.

In this machine the pendulum is kept in motion by foot pressure upon the treadle, and it punches easily a three eighths inch hole in one quarter inch iron, and an inch hole in one eighth inch plate, six inches from the edge. It is designed to do boilermakers' small work, as well as for the use of sheet metal workers, and especially brass manufacturers. The opening in the bed is six and a half by four inches.

The press weighs 380 lb., and, with the exception of the pendulum and treadle, is in all respects similar to power presses used for the same purposes. With it a boy can easily do all the work by foot as rapidly as by power press and without fatigue. The pendulum can be readily removed and a balance wheel attached to the shaft for power when desired.

To test the capacity of one of these small presses, the manufacturers state that they attached a thirty inch balance wheel, with three inch belt, to the shaft, and with a speed of 125 revolutions per minute they could not punch an inch hole in one eighth inch iron; while the pendulum, worked by foot alone, enabled the machine to punch such holes rapidly and continuously.

This press stands about four feet high, occupies comparatively little space, and seems very substantial. The punch may be easily removed, and a shear may be inserted in the slide for shearing light sheet metal.

These presses are protected by several patents, and are made by the Peerless Punch and Shear Company, 52 Dey street, New York city.

NEW FLANGE COUPLING.

The annexed engraving represents an improved flange coupling recently patented by Mr. Charles H. Cushing, of

CUSHING'S FLANGE COUPLING.

Tidioute, Pa. It is designed for connecting sections of pipe at any angle to each other, from a straight line to an angle of 90°.

The invention consists of two circular plates, each flat upon one side, and having on the other a short internally threaded tubular projection inclined at an angle of 45° to the plane of the plates. The plates are slotted to receive the bolts that fasten them together. This coupling serves as an elbow for pipe and for forming in pipes a joint of almost any desired angle.

A FEW WORDS TO YOUNG STEAM FITTERS.

BY A STEAM FITTER.

Feed Pipes.—The feed valve should be a globe or angle valve placed near the boiler, with the fewest possible joints in the feed pipe between it and the boiler. If it is a loose or swivel disk valve, it should be secured with solder (sweated in) in the threads of the double part of the disk, so as to make it almost impossible to lose the disk from the stem; a mark with a center punch or chisel is not enough. The valve should be so turned toward the boiler that the inflowing water will be under and against the disk, so that in the case of the loss of the disk it will not act as a check valve against the influx of the feed water. This arrangement will bring the pressure of the water in the boiler always against the stuffing box of the valve; but all things considered it is best.

The check valve should be close to and outside the feed valve, with only a nipple between them. Always use horizontal check valves, as they admit of easy cleaning. With the ordinary vertical check it makes it necessary to take down some part of the feed pipe to clean it.

When two or more boilers are fed from the same pump, or when the pump is used for pumping water for some other purpose, it is well to have a stop valve on each side of the check valve, as it will enable the engineer to get at his check without stopping the water to the other boilers or elsewhere.

In passing through boiler walls or cast iron fronts, care should be taken that the feed pipe does not nest, or the settling of the boiler will break it off.

Use a flange union on the feed pipe instead of the common swivel union; the engineer can take it apart with a monkey wrench, and it makes a more permanent job and it will not leak.

Never put a T in the feed pipe inside the feed valve for the purpose of a blow-off; make a separate connection to the boiler.

Blow-off Cocks.—Never use anything but a plug cock of the best steam metal throughout. The reasons for using a cock are that the engineer is always sure when he looks at it whether it is shut or open. It gives a straight opening; if chips, packing, or dirt gets into the cock it will shear them off when closing, or if it does not, the engineer knows it is not shut. Do not use an iron body cock with brass plug, for when the cock is opened to blow down a little the hot water expands the plug of the cock more than the body, and it is almost impossible to close it. Do not use a globe or angle valve, as you cannot always tell when it is shut; a chip or dirt getting between the disk and seat will prevent its closing. I have seen two fine boilers destroyed from this cause. Gate or straight-way valves are subject to the same objections as globe or angle.

When it is practicable there should be a T with a plug in it in the blow-off pipe outside the blow-off cock, the plug to be removed when the cock is closed. By this means the engineer can always tell if he is losing water from his boiler.

The blow-off pipe should be large, with few bends in it, and fire bends are better than elbows. It should be attached to the bottom of the shell of a horizontal boiler, and not tapped into the head a few inches up. When there is a mud pipe, attach it to it at the opposite end from the feed pipe.

Safety Valves.—They are the main stay of the engineer, acting both as a relief and a warning signal. They should be attached to the steam dome high up. At the side is better than the top, as they are not so liable to draw water when blowing off in that position. They should be large and have a large pipe connection all to themselves. The ordinary cross body safety valve is very much to be condemned, and I think in some countries there are regulations against their use; they are constructed to save making an extra connection for the main steam pipe, thereby drawing the largest amount of steam directly from under the disk of the safety valve. A weighted safety valve is better than a spring valve when it can be used, as the lifting of the valve makes practically no difference in the leverage; not so with a spring valve, for the higher it is lifted the more power it takes to compress the spring.

Gauge or Try Cocks.—Gauge cocks are various in style, the wood handle compression gauge cock being a very good kind for all purposes. When setting gauge cocks care should be taken that they are not too low, and that the drip will not flow over the person who tries them. They should be tapped directly into the boiler if possible; but when it is necessary to use a piece of pipe to bring them through a boiler front or brickwork, give the pipe an inclination backward, that the condensation may run back and into the boiler. When the pipe inclines outward and down, the condensation remains in it and the cock, and will deceive the unwary, giving the appearance of plenty of water with a short blow.

Glass Water Gauges.—Water gauges are best set when attached to a vertical cylinder at the front of the boiler. The cylinder should be connected to the boiler with not less than one inch pipe, top and bottom; the top or steam connection should be taken from the boiler shell near the front head, and not from the dome or steam pipe, as the draught of steam in either will cause the glass to show more water

than the boiler contains. The bottom or water connection should be taken from the front head at a point where about two thirds of the water in the boiler will be above it and one third below; this will lessen the chances of the pipe stopping up with mud, etc., and it should also be provided with a half inch pipe at the lowest point for a blow-out. When gauge glasses are set this way the condensation in the cylinder is downward, and the flow of water being toward the boiler through the bottom pipe, the tendency is to cleanse the glass and cylinder and keep them so.

Steam Gauges should never be set much above or below the boilers to which they are attached, as each two feet of fall or elevation from the direct connection is nearly equal to a difference of one pound on the steam gauge; always when the gauge is below, for the condensation in the gauge pipe fills it with water, which leaves a pressure on the steam gauge equal to the hydrostatic head, which is a little over two feet perpendicularly to the pound per steam gauge, giving the gauge the appearance of being weak. When the gauge is above it is not always so, though generally, the pipes being long and of small diameter or trapped, which prevents a circulation of steam in them, they fill with water, which acts against the pressure from the boiler and gives a gauge the appearance of being strong. A good way is to connect the gauge pipe to a boiler below the water line, say 12 or 18 inches, and have the gauge on the boiler about 12 inches above the water line, using no water trap or siphon, that the water may run back from the gauge when there is no pressure in the boiler, thereby preventing the possibility of freezing or of getting steam to the spring of the gauge.

Sometimes a steam fitter has to run a gauge pipe a long distance to an office or engine room. When such a gauge is far above the boiler he should run a large pipe direct from the steam dome and give it sufficient pitch to clear itself of water; it should be covered with some non-conducting material, and be of such size that the flow of steam through the pipe to supply the loss by condensation will be so slow as not to interfere with the flow of water along the bottom of the pipe in a contrary direction, and it should have a siphon immediately under the gauge.

When it is necessary to have a gauge very much lower than a boiler, fill the pipe with water, but before doing so remove the glass and lift the hand or index over the stop-pin and mark where it remains stationary; now fill the pipe to its highest point with water, then with two knives draw the index from its spindle and set it back to the mark where it remained stationary before the pipe was filled, and press it on; then bring it to its normal position on the stop pin and adjust the glass.

The Main Steam Pipe for Heating Apparatus should be high up on a boiler, and any pipe larger than 2 inch should not be tapped in, but connected with a flange bolted or riveted to the boiler. Two and a half inch pipe and larger sizes have eight threads to the inch, and will not make a good job otherwise.

Automatic water feeders, combination water gauges, or steam gauges, should not be tapped into the steam heating or engine pipe, as the draught of the steam through the pipe interferes with their proper working.

Engine or pump pipes should not be taken from the steam heating pipe, as the draught they cause relieves the pressure in the heating apparatus and spoils the circulation, especially if it is a direct return gravity circulation.

With an automatic return steam trap applied to an old job, if the steam heating pipe is large enough, it will not be necessary to move the engine pipe, but should the circulation be still defective, remove the engine pipe to shell of boiler remote from heating pipe. W. J. B.

PROCEEDINGS OF THE AMERICAN ASSOCIATION.

Subsequent to our last week's report, at one of the general meetings the chief incident was the reception of Professor Otto Struve, Director of the Imperial Observatory at Pultowa, Russia. Professor Struve explained his mission to America in the interest of the observatory under his care, and announced that Messrs. Alvan Clark & Sons, of Boston, Mass., had undertaken to construct for it the finest telescope the world could produce.

Among the more valuable papers read were: Professor Peirce's on the meteoric constitution of the sidereal universe, in which he developed at great length the theory set before the readers of the SCIENTIFIC AMERICAN last winter. Professor Leeds, of Stevens Institute, reviewed the long standing problem as to the solubility of ozone in water, and gave the reasons for believing that it is so dissolved, and that it retains in the solution its characteristic oxidizing power. Professor H. W. Wiley, of Purdue University, Lafayette, Ind., described an improved method of collecting and measuring gases soluble in water, and Professor F. W. Clarke, of Cincinnati, gave a preliminary notice of results obtained in an elaborate revision of the calculations determining the atomic weights of the chemical elements.

The paper of Professor Goode, of Middleton, Conn., on the menhaden, presented that cousin of the shad as not only the most valuable of the food supplies of edible fishes, but as the most important source of fish oil. Its annual yield of oil exceeds that of the whale (from American fisheries) by 200,000 gallons; and in the commercial value of all its products it is surpassed by but three fish: the cod fishery, estimated in 1876 as yielding $4,836,000; the whale fishery, $2,850,000; the mackerel, $2,275,000. The value of the menhaden taken this year amounted to $1,658,000.

Major Powell delivered, in Section B, the suggestive and valuable address on Mythologic Philosophy, printed in the SUPPLEMENT last week; and Professor Stephen P. Langly, whose instructive series of articles on the Sun has just been completed in this paper, discussed the same subject in his address as vice-president of Section A.

Commander E. P. Lull, U.S.N., read an important and timely paper on the Interoceanic Canal Problem, illustrating by maps and diagrams the several routes surveyed. The character and advantages of the Nicaragua route were specially dwelt upon; and the belief was very positively expressed that no commercially practical route without locks had been found.

Professor Draper's paper on the Identity of the Lines of Oxygen with Bright Solar Lines, as shown in photographs taken with increased dispersion, was read, in his absence, by Professor Barker.

A very popular and enjoyable paper was Mr. Wm. T. Hornaday's on the Orang-Outangs of Borneo. Touching the possible human relationships of the orangs, Mr. Hornaday said:

"Let such a one (if, indeed, such a one exists to-day), who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink, and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the Cooly women of Hindostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage—let him see all this, and then he may feel how much more patent has been this lesson than all he has read in pages of abstract ratiocination."

Another interesting paper was on the Serpent Myths of the Red Men, by Judge J. G. Henderson, whose paper on superstitions connected with the rabbit, among our Indians and other primitive people, had been listened to the day before.

Mr. Edison's electro-chemical telephone was exhibited and explained by Professor Barker, and Mr. Edison, the inventor, acting also as draughtsman for the blackboard illustrations.

President Barnard, of Columbia College, read a paper on the Past State of the World's Metrology as Bearing on the Progress of Science, in which the progress of modern science was shown to hinge on the possession of exacter means of measurement than the world had previously known.

The chief paper of the closing day was Mr. Edison's on the Phenomena of Heating Metal in Vacuo by Means of an Electric Current, a report of which will be found on another page. Both this paper and that by Mr. Edison's mathematical assistant, Mr. Upton, on Tests of Faradic Machines, furnish ample confirmation, if it were needed, of the position we took last week in respect to the scientific investigations of modern inventors.

In this brief notice it is obviously impossible to do anything like justice to the multitude of valuable papers presented to the association. It has been an active, earnest, business-like session, as notable for its good work as for its full attendance. The place of meeting had been happily chosen, the weather was favorable, and all the external conditions conspired to make the meeting as pleasant as it was profitable.

It was resolved to hold the next meeting in Boston, beginning the last Wednesday in August, 1880. The following officers were elected for the coming year:

President—The Hon. L. H. Morgan, of Rochester.

Vice-President, Section A—Professor Asaph Hall, of Washington.

Vice-President, Section B—Professor Alexander Agassiz, of Cambridge.

Permanent Secretary—Professor F. W. Putnam, of Cambridge.

General Secretary—Professor John K. Rees, of St. Louis.

Secretary of Section A—Henry B. Nason, of Troy.

Secretary of Section B—Professor C. V. Riley, of St. Louis.

Treasurer—William S. Vaux, of Philadelphia.

The Remarkable Spot on the Disk of Jupiter.

To the Editor of the Scientific American:

Having from time to time seen in the SCIENTIFIC AMERICAN notices from your correspondents respecting the appearance of black spots upon the disk of the planet Jupiter, I

have of late watched with all possible care for such phenomena, but have seen no spots save such as any experienced observer would readily recognize as being produced by the transit of a satellite or its shadow. However, on the 25th inst., at 9:30 P. M. time at this place, I observed advancing upon the eastern wing of the planet, midway between the southern equatorial belt and the southern gray zone, a dusky patch of irregular outline, which in one hour and fifty-five minutes reached the position and assumed the appearance, shown in the accompanying rough yet faithful diagram.

The length of this patch when seen in the position shown was little more than one-fifth of the planet's diameter, and about one-fourth as broad as long. Color, decided pink; indeed the color at times appeared so vivid as to make the equatorial belts, usually of a dusky red color, appear by contrast of a somber gray.

From the first appearance of this patch until it commenced to pass off on the opposite limb, the time elapsed was three hours and fifty minutes. The same phenomen on was again observed on the evening of the 28th inst., without any apparent change.

These observations were made with an achromatic of four inches aperture.

Phenomena of this kind, though not unknown, are of rare occurrence. South mentions having seen a large spot, somewhat of this kind, on the 3d of June, 1839, but of so evanescent a nature that it partly disappeared before a sketch of it could be made. I have recently noticed other disturbances of the Jovial atmosphere well worthy of vigorous scrutiny with the highest optical aid.

As some of your readers are students of astronomy, I should be pleased to know the results of their observations on this subject. F. S. DAVENPORT.

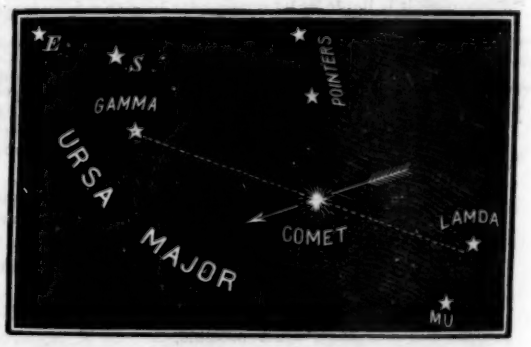
Jerseyville, Ill., Aug. 30, 1879.

ASTRONOMICAL NOTES.

PALISA'S NEW COMET.

It was my pleasure to obtain, at half past three o'clock this morning, very good observations of the new comet discovered by Palisa at Vienna on the 21st inst. It is not well situated for observation in this part of the world, owing to its slight altitude in the morning before daybreak, and in the evening the moon at present interferes. Notwithstanding this, it is quite a conspicuous object in the telescope, about twice as bright as Swift's last comet. It must really be a magnificent object in localities where it can be seen at a good elevation, as was the case when discovered. It is now nearly pointed at (south) by the "pointers" in Ursa Major, being in that constellation, and nearly on a line drawn from *Lambda* to *Gamma* Ursæ Majoris.

The comet is directly opposite the Pole Star from the



"pointers," and moving slowly toward the southeast, as indicated by the arrow in the diagram.

GRANDEUR OF THE MORNING SKIES.

A grander spectacle seldom greets the eye of man than that presented by our early morning skies at the present time. Three gorgeous planets form a royal girdle across the heavens. Jupiter in the west, Saturn high in the south, Mars well up in the east, and beyond, almost in a direct line with these planets, ruddy-faced Aldebaran. Overhead Cassiopeia and the Pleiades. Well down in the east noble Orion on his ride, while later, in the morning glow, shines silver-faced Sirius, in splendor rivaling Venus in the evening twilight. He who misses these grand scenes, misses royal soul feasts that the gods might envy.

SUN SPOTS.

A very pretty group of sun spots was observed on the 24th, just below the center of the disk, now much changed and nearing the western limb, but surrounded with intensely bright faculæ. Yesterday morning an interesting group appeared on the eastern limb with the faculæ very marked, and giving in its structure manifest evidences of rapid change. This morning confirmed the impression, for a large spot, unseen before, had broken out, and numerous small ones. Its appearance this morning (28th) is indicated in Fig.

2. This group of spots will be watched with interest as it traverses the solar disk, and may be seen with quite a small telescope. WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., Aug. 28, 1879.

MISCELLANEOUS INVENTIONS.

Mr. Edward R. Mollenhauer, of New York city, has patented an improvement in violins which relates to the arrangement of their interior, effected without changing their outward form or structure or altering the manner of playing them This improvement increases the power of the instrument, and gives greater roundness and fullness to its tone without sacrificing any of its special and peculiar properties. The invention consists in interposing a board at any intermediate point between the belly and back of the instrument, parallel thereto, so as to divide the interior into two chambers, and providing the board with sound post, sound ports, and a bass bar.

An improved fastening for shoes, etc., has been patented by Mr John Howenstine, of Fort Wayne, Ind. It consists of a case secured to the flap, in which is pivoted a catch, held in position by a spring. A tongue is fastened to the other side of the opening, which is adapted to enter the case and to be engaged by the catch. The catch is made to release the tongue by pressing the projecting end with the finger.

Mr. Thomas B. Mosher, of Portland, Maine, has invented an improved ruler, which consists of a narrow strip of suitable material, made flat on its under surface to prevent rolling, provided with a sharp edge to serve as a paper cutter. It has a hollow cylindrical back piece running its whole length on its upper surface, so combined with it as to form a step along the line of junction. This step is sufficient to prevent ink from soiling or blotting the paper. The back piece is made hollow throughout for holding pencil or pen handle, or other articles, and in each end there is a plug, one forming the handle of an ink eraser, the other forming the handle of a piece of erasive rubber

An improved process for removing the germ and fuzzy or woody fibers found upon the ends of wheat and other similar grains before reducing the grain to flour has been patented by Mr Samuel Potts, of Minneapolis, Minn. The process consists in separating the grain kernels into grades of uniform length, and treating the grades in a continuous operation in separate mills, having each a stationary roughened surface and an opposing revolving roughened surface, these surfaces being rigidly adjusted with respect to each other at a distance apart which is invariable, and greater than the lateral axis of the grain kernels, and less than their longitudinal axis.

An improved life preserving suit, patented by Mr. Frank Vaughan, of Elizabeth City, N. C., has a lower section made in the form of rubber pants, distended and protected by rigid frames and rings, and having a sectional annular float at the waist. It is worn in connection with a rubber shirt having a strap and draw cords to connect it with a flange on the float.

Mr. Anson L. Sonn, of Toledo, Ohio, has invented a novel brush, which is an improvement in the class of hair and other bristle brushes having sheet metal back or casing. It consists in constructing the case or frame of the brush of two metal parts, one being let into or inclosed by the overlapping edges of the other, and united to form a water-tight joint.

Mr. James A. Peek, of Beloit, Kan., has patented an improved scraper for use upon railroads, ordinary roads, and in other places where grading is to be done, or soil moved from place to place. The invention consists in a novel combination of devices which cannot be described without engravings.

An improved mail package has been patented by Mr. George Bassett, of Chicago, Ill. It consists of an outer metal case made in two parts, each having a perforated head and inside rubber springs, on which the transparent box containing the samples or other articles is held, so as to be free from the jarring and pressure to which the package is subjected.

A horseshoe, provided with a spring attached to the under side of the toe and carried back in a median line to the heel, and then brought up in an enlarged form on a double or fold to support the frog of a horse's foot, has been patented by Mr. George Bacon, of White, Mich.

A lamp stand, which can be readily attached to a table, shelf, sewing machine, etc., and will securely hold the lamp placed in it, has been patented by Mr. Joseph Robison, Sr., of Birmingham, Conn. A clamp grasps the edge of the sewing machine table or shelf, and is firmly secured by means of a screw. The lamp sets in the ring with its handle between two uprights; a slide, moved down upon the lamp handle, holds the lamp in place.

A simple and, it is claimed, unfailing device for instantly detaching horses from vehicles, whether in motion or at rest, has been patented by Mr. Elijah Stevens, of Somerville, N. J. By this device a horse is attached to a vehicle securely, and in case of threatened accident he can be instantaneously disengaged, the strength of a child being sufficient for the purpose.

An improved butter package, constructed so as to keep the butter sweet and pure for any desired length of time, and which can be conveniently transported, has been patented by Mr. Arthur White, of Derby Line, Vt.

An improved barbed fence wire has been patented by Mr. John A. Duncan, of Kansas City, Mo. It consists in providing the main wire or wires with a loop or loops, and passing the wire barbs through the loops and twisting them together and around the wires so that they will be at right angles to each other and held immovable in their places.

A purse or pocketbook fitted with devices for registering or printing figures upon a strip of paper by the act of closing the purse or book, has been patented by Mr. Hugh C. Baker, of Hamilton, Ontario, Canada. The figures are adjustable, so that they may be set to print as desired. The device is intended for keeping an account of money taken from the purse from time to time without the necessity of using a pen or pencil.

An improved brick kiln has been patented by Mr. Thomas S. Hawkins, of Chattanooga, Tenn. The kiln is built in the form of a cupola furnace, with a chimney stack connected to the upper part of the burning chamber. In the lower part of the chamber is a platform that is raised and lowered by a screw. Access to the platform is had through an opening at the bottom of the kiln, through which the bricks can be removed.

An improved device for sprinkling water or other liquid in a fine spray upon clothes, plants, tobacco, leaves, and for various other purposes, where the liquid is required to be delivered in a fine spray, is the invention of Mr. James H. O'Connor, of Helena, Ark. The sprinkler consists of a cup, having a handle, a convex perforated plate or rose, and a valve, which facilitates the entrance of water into the cup by permitting the air to escape.

An improvement in sugar evaporators has been patented by Mr. James F. Sargent, of Strafford, Vt. This invention relates to improvements in the construction of the furnace and evaporating pans used in the manufacture of sugar. The object of the improvement is to direct the fire under the whole or a part of the pan; also, to enable a part of the pan to be used for boiling sap and another part for granulating the sirup.

Mr. Almon P. Whiting, of Astoria, N. Y., has invented an improved rail tie, to which rails may be firmly secured in a novel manner. The rail tie is double flanged and notched to receive the rails, and the rail is secured by a slot bolt and a clip of peculiar form.

Cumberland Mountain Caves.

One of the members of the Harvard University Summer School of Science (which, under the direction of Professor Shaler, has been studying the geology of the Cumberland Mountains in Virginia) writes from Pennington's Gap to the Detroit *Free Press* describing some of the caves of that region. He says:

"There are numerous small, and a few large, caverns in the limestone hills about here, but none of them have any true cave beetles. In one cave I descended into a pit by means of a rope, and from this pit into a second pit, in which I found the floor strewn with bones of cave bear, cave men, and five or six other animals, all of which I got out and packed for the survey. The largest cavern I have examined is only two miles from camp. I have spent three entire days in exploring it, of course returning to camp each night. Of three passages examined I reached the end of but one. I walked for four hours through one series of chambers, which constantly increased in size as I went on, and was obliged to turn back without finding any end, simply because I could not carry in mind the many land marks that had to be remembered on the return.

"This cave contains the most exquisite chalcite and gypsite formations. One large chamber is lined for half a mile with delicate frostwork of crystals as white as snow. The walls seemed to be draped with folds of ermine puffed with bunches of ostrich plumes. In other places are sloping banks covered with an apparently vegetable growth of fungi, moss, and ferns, but all formed of chalcite needles or bunches of white, brown, rose pink, and crystal clear gypsite. There are pillowy masses, like couches of eider down, inviting the tired explorer to repose, but stinging like nettles the hand that brushes, no matter how lightly, against their bristling points. There are ledges, like the shelves of a museum, stored with branching coral. This part of the cave exhibits the perfection of this kind of cave ornamentation, and was said by members of the survey to be unusual in its extent and beauty. Other parts contain curious stalactite and stalagmitic formations, such as one sees in many other caves, halls of statuary, giant coffins, waterfalls, organs, and unexpected imitations of natural and artificial objects."

Explosion in a Bessemer Shop.

An accident occurred at Sheffield, England, the other day, which shows the danger of experimenting with petroleum in blast furnaces. The men in the Bessemer shop of Messrs. Brown, Bayley & Dixon's works had been engaged in what is known as the "patent injector experiment," in the course of which an apparatus for blowing vaporous petroleum by steam through molten metal is used, so as to render it hotter —"cold heat," as it is technically called. Shortly before seven o'clock the last of these experiments was being conducted. If it works well, combustion is immediate at the tuyere holes, and thus none of the heat caused by the presence of petroleum is lost. In this instance the experiment was on the point of being concluded, and some thirty men were engaged in the final operations, when an explosion, which shook the entire building, and was heard over the whole district, took place. Mr. Cooper, the acting manager, was at the works, and the inquiries he made showed that the petroleum had exploded in the box of the patent injector (or the vessel used in the experiment) containing the molten metal, and had blown the bottom lid of the latter off. The vessel then turned down, as usual when the experiment is concluded, and the molten metal commenced to run into the pit below, but fortunately no one was there, for the men had run for their lives as soon as they saw the danger. The foreman, however, did not escape, and he was somewhat severely singed over the face and arms. The cause of the explosion is attributed to the fact of there being an excess of petroleum—some of it vaporized—in the box, and that this larger quantity, coming into contact with the air, caused it to spring into a flame, and led to the explosion.

A NOVEL EXHIBITION.

The Royal Agricultural Society of England has issued a circular calling for examples of agricultural engines and machines for their next exhibition, which have been damaged in part or entirely by the incapacity or negligence of the operatives.

It is a novel idea, but such a collection of machinery as it proposes to get together is calculated to do much service to the manufacturer, who can inform himself wherein his machine may be improved in the whole or strengthened in parts, and not less so to the farmer or owner of the machine, who will thus be informed of the incapacity of his employés. The society also request that a written statement accompany each exhibit, stating the circumstances under which the damage was done. These specimens are to be displayed in a special shed in the show, which is to be held at Carlisle, on the 1st of July, 1880. Early notice is thus given that farmers may preserve their injured machines for the exhibition.

In addition to the great loss of property caused in the mismanagement of agricultural machines by incompetent help, a great many innocent persons lose their fingers and some their lives from the same cause. Such an exhibition is intended to form the basis for further investigation, first as to the cause, and then to devise a remedy for such evils.

Progress in Railway Making.

In a recent address Mr. Edmund Smith, one of the vice presidents of the Pennsylvania Railroad, said that thirty years ago 10,000 tons each way daily, or 7,000,000 tons a year, was thought to be the maximum capacity of a double track railway between Philadelphia and Pittsburg. Yet in 1878, the tonnage of the Pennsylvania Railway was 11,000,000 tons, and the extent of its capacity is far from having been reached. In loading cars, a few years ago the rule was one ton to a wheel. The cost of moving one ton one mile under the most favorable circumstances on first class railroads a few years ago was 1 cent; now it is reduced to ½ cent. The most important element in causing these reductions has been steel rails, which are furnished now at two thirds the cost per ton of iron rails 30 years ago. He did not think there was any reason why we should not go on to improve and develop the system in the future as in the past, and he ventured the opinion that the day is not far distant when the main lines of railway will be illuminated at night by the electric light, while other and greater improvements will keep pace with the spirit of the age.

Impurities Contained in Glacial Acetic Acid.

The actual acid present in the 57 specimens examined varied from 87 to 99·5 per cent. The author finds that the oil of turpentine may serve for determining with exactness the acid present. For this purpose he takes 10 c.c. of the sample, and carefully drops into it oil of turpentine from a burette graduated into tenths of a c.c. until the last drop added dissolves after slight agitation without producing a permanent turbidity. The quantity of oil which may thus be added increases with the quantity of pure acid. In samples above 99·5 per cent in strength the oil dissolves in any proportion. To obtain comparable results the samples operated upon should be at one and the same temperature, 15° being the most suitable.

In practice it is sufficient to add to a known volume of the acid eight or ten times its volume of the oil and to stir two or three times. If the mixture remains clear the strength of the acid is at least 97 to 98 per cent. Otherwise it should be rejected.—*M. Bardy.*

English Silk Mills to Remove to New Jersey.

We have had several occasions lately to mention the transplanting of English manufacturing establishments to this country. Another significant and important move in this direction is reported in the New York *Times* of August 31. It appears that three gentlemen prominently engaged in the manufacture of silk in Macclesfield, formerly the great center of that industry in England, have been visiting the silk mills of Paterson, N. J. One of the gentlemen builds silk machinery, and hearing of the great prosperity of the Paterson mills, he thought he would find a market for his machinery in that city. He was surprised to learn that nearly all the machinery wanted is made in Paterson, one silk manufacturing company making all its own machinery on the premises. One of the other visitors is superintendent of a large silk mill in Macclesfield, and the other is the son of a great mill owner. Both of these gentlemen, after a tour of the Paterson mills, confessed that the American manufacturers had nothing to learn from their English rivals, but that the latter had much to learn from the former.

A NEW INDUSTRY—FROG FARMING.—A Mr. Soule, of Elgin, Ill., is in his third year of frog farming, and his first crop is now being marketed. He has an acre and a quarter devoted to the frog industry. The kind grown is the "Goslin frog," much larger than the common sort. Mr. S. will, next season, furnish St. Louis, Chicago, and Cincinnati with frogs, and is confident of success in the business.

Proposed English Channel Bridge.

A recent project is the scheme for bridging the English Channel, put forth by M Verard de Sainte Anne, France. He maintains that his bridge scheme is preferable to the tunnel scheme, because its execution would not cost more than 300,000,000 francs, whereas the tunnel could not be constructed for less than 500,000,000 francs. M. De Sainte Anne, moreover, affirms that his viaduct could be constructed in a much shorter space of time than the tunnel.

As described in the London *Standard* the proposed viaduct is to span the Channel from Cape Grisnez to Folkestone. According to the Admiralty soundings the greatest depth of water to be found on the passage is fifty five meters, and this is only for a distance of some four kilometers about half way between the Varne Rock and the French coast. This Varne Rock and its neighbor, the Calbart Reef, play an important part in the scheme. The former, situated at fifteen kilometers from Folkestone and twenty kilometers from Cape Grisnez, is some four kilometers broad, covered with no more than from two to fifteen meters of water. Being of solid rock, and in a direct line with the projected viaduct, it offers itself as a natural half-way resting place. This rock has, till now, constituted one of the greatest dangers to the navigation of the Channel. M. De Sainte Anne proposes not only to turn it to account by using it as the foundation for a portion of the viaduct, but also, in conjunction with the Calbart Reef, for the construction of a free port in which vessels of the greatest tonnage will be able to seek shelter from the storms so frequent in the strait which separates England from France. Both for the construction of this port and for reducing the depth of the water to twenty meters in those places where he will be obliged to construct his columns, M. De Sainte Anne proposes to adopt the method employed in the construction of the Cherbourg breakwater, which consists in dropping huge masses of rock into the sea, and in consolidating them by means of Roman cement.

On the foundations thus established it is intended to raise solid masses of masonry to some forty meters above the level of the sea. This is, of course, a gigantic work, the immensity of which will be seen at a glance, when it is remembered that M. De Sainte Anne does not contemplate attempting in his viaduct any span exceeding two hundred meters. The distance from Folkestone to Cape Grisnez being thirty-five kilometers, it will, therefore, be necessary to construct at the very least 175 immense blocks of masonry on which to place the superstructure. As to the superstructure itself he proposes to employ three systems. On the Varne Rock and at the two extremities where the water is shallow and the exigencies of navigation permit, he proposes to construct solid stone arches which will have nothing to fear from the fiercest tempest. This massive masonry is to be followed by the girder bridge system, such as employed in the Charing Cross railway bridge. But to span the deep water he has recourse to the tubular bridge system as applied by Sir Robert Stephenson in the erection of the Menai bridge. With these three systems combined he believes that he is not only certain to succeed in crossing the Channel, but also in satisfying the demands of every government concerning the precautions to be taken to prevent the navigation of the English Channel being rendered even more dangerous than it is at present.

The Bite of the Skunk.

In the *Forest and Stream*, of recent date, is a contribution to the question whether the bite of the skunk is poisonous and will produce rabies. In the West and Southwest of the Mississippi Valley this seems generally believed. A writer from Colorado quotes several instances.

Dr. Cushing, of Trinidad, Colorado, who has, no doubt, seen several cases, gives it as his opinion that the natural bite of the skunk produces hydrophobia—that it does not need to be suffering from rabies itself. He says its bite will kill the victim sooner or later, without fail. Dr. W. L. South, who has had great experience in Texas and New Mexico, says "the bite will fetch the victim some time," meaning that it will sooner or later result in death.

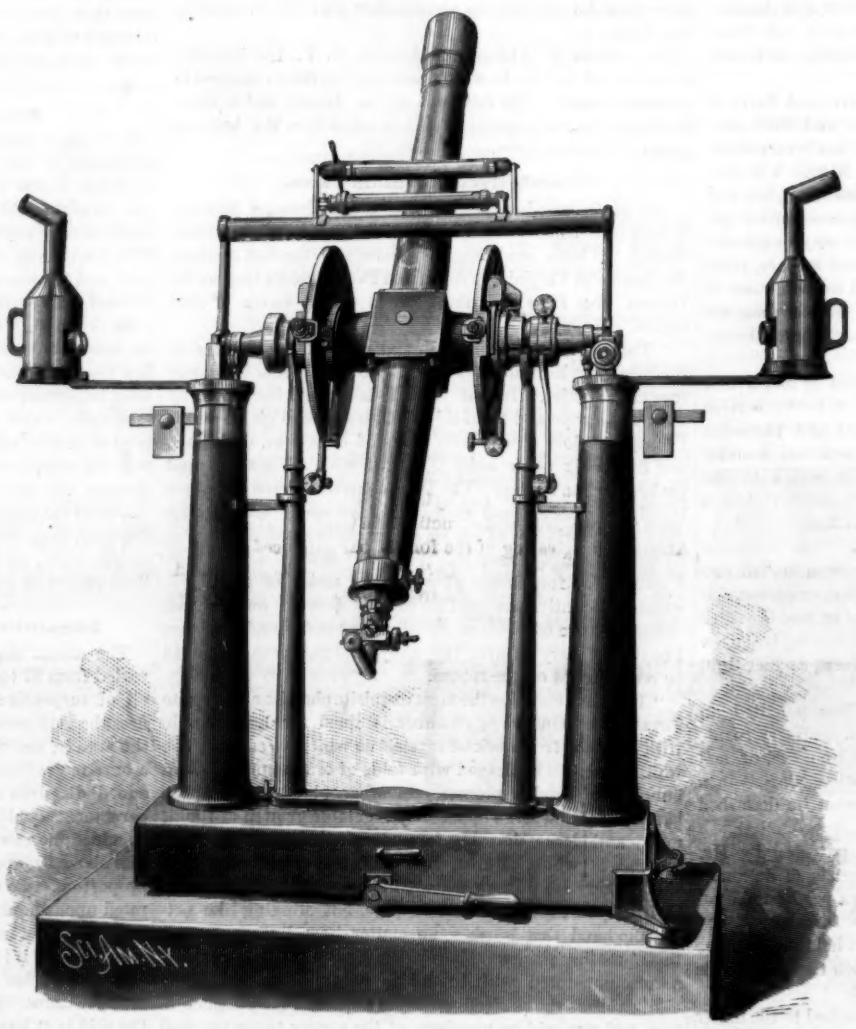
We do not believe this is the case in the Eastern States. The skunk is very common in Pennsylvania. We have seen dogs bitten by it, and have known those who hunted it constantly for its valuable skin, but have never heard of any such ill result from its bite either in man or dog.—*Medical and Surgical Reporter*

Relation of Religious Belief to Epidemics.

The Montreal *Witness* states that diphtheria is more prevalent among the Protestant section of Montreal community than among the Catholic. It is not a mere coincidence, nor is it of a temporary character. A study of the health statistics of Montreal for several years past reveals the same state of things. It is the more peculiar, inasmuch as the general death rate is much higher with the Catholics, particularly so in contagious diseases, and conspicuously so in the case of smallpox. But these admit of explanation. The only solution of the problem seems to be that the bulk of the Protestant community reside in the upper part of the town, where the drainage is less perfect than in the lower town.

NEW FORM OF TRANSIT INSTRUMENT.

The engraving represents an instrument made by Fauth & Co., of Washington, D. C., of the same class as the one described in our issue of August 23, being a transit instrument of smaller and more portable size. This instrument—of which quite a number have been made by Fauth & Co. for colleges in this country, as well as Mexico and Japan—is complete in itself, having base, standards, and reversing apparatus all in one piece, and is, as a glance at it will show, "American," being as convenient and adapted to the purpose as it can well be. As generally made, this instrument has a telescope of 8 inches aperture; the circles, which are divided on the edge, the graduation thus facing the observer, are from 12 to 13 inches in diameter; the latitude and striding level are sensitive to single seconds and chambered. Improved machinery, division of labor, and the great saving of time by only finishing the parts that require it, enable this firm to successfully compete in price with European makers. All the parts not polished are coated with "flocking." This finish gives the instrument a beautiful appearance, and makes handling comfortable, especially in cold weather.



FAUTH & CO.'S PORTABLE TRANSIT INSTRUMENT.

Prosperity in the Lumber District.

According to the *Northwestern Lumberman* the lumber interests of the West, which have been so greatly depressed along back, are now prosperous. There is a sharp demand for lumber, and thus far light receipts, which is pushing prices upward. From the same source we learn that the Hon. Erastus Corning, of Albany, N. Y., has formed a connection with Wm. H. Gratwick & Co., of Tonawanda and Albany, and Oscoda, Mich., for the handling of his entire stock of lumber, embracing some 200,000,000 feet, the product of his large and valuable tract of pine timber on the western shore of Michigan. This gigantic enterprise comprehends about $4,000,000 in value, supposing the lumber to have been marketed. Gratwick & Co., who own about 30,000 acres of fine timber land, will curtail the cutting from their own lands somewhat while the Corning tract is being operated.

Photography of the Spectra of Geissler's Tubes.

The spectrum of *hydrogen*, which appears to the eye to consist of only four lines, showed when photographed upon gelatine plates, besides these four lines, hundreds of lines in the blue, violet, and ultra (invisible) violet. Many of these are light and delicate, while some are of extraordinary density. Among these are, besides the mercury lines, four lines in the ultra violet and one which coincides with the thick first H line of the sun's spectrum. The length of the undulations of the lines was measured, and their position as respects the Fraunhofer lines of the sun's spectrum determined.

The spectrum of *mercury* in the Geissler tube furnished in the photograph, besides the remarkable lines in the blue and violet which Thalen saw and measured, a surprising group of lines lying far into the ultra violet (length of the wave of the outermost, 3650). The spectrum of the mercuric spark in the open air coincided in many points with the spectrum of mercuric vapor in the Geissler tube, but it also differed from it in a surprising way. Thus, in the spectrum of the Geissler tube, the distinct line close by H in the violet was absent, while, on the other hand, in the violet and ultra violet it showed a variety of bands which were not present in the spectrum of the spark in the open air between the poles of mercury.

The spectrum of *nitrogen* in the Geissler tube furnished a very characteristic photograph, with magnificent lines in the violet and ultra violet. Several of the latter far exceeded in intensity the visible lines in the violet. The appearance of the lines in the photograph was quite different from that which is given to them in ordinary drawings; they formed no simple shaded-off bands, but sharply defined lines, at the most strongly refrangible side of which lay a weak, washed-out looking band.

The nitrogen lines in the pale blue, which appear strongest to the eye, exercised but a slight action on the photographic plate, and on the green lines even a slighter.

If nitrogen and mercury be both inclosed simultaneously in the same Geissler tube, with a spark one gets the lines of both elements; but if the tube be warmed, the nitrogen lines disappear and only the mercury lines remain. This has already been observed by Herr C. Wiedemann. Thus, if one were to photograph upon the same plate the spectrum of a nitrogen tube containing mercury in a cold and in a warm condition, he would easily get the spectrum of nitrogen and that of mercury together, and by comparison he would be able to recognize which lines belong to one element and which to the other. The nitrogen spectrum reaches as far into the ultra violet as the mercury spectrum.

Then I photographed the spectrum of an electric spark struck through atmospheric air, oxygen, and carbonic oxide gas. Thus upon one and the same plate we had all together the spectra of oxygen, atmospheric air, and carbonic oxide gas. The comparison of the pictures showed that the carbonic oxide gave by preference oxygen lines, and that by the spark it was decomposed into oxygen and carbon (the latter was actually visibly drawn out to the poles.)

It was further observed that the spectral lines which are ascribed to the atmosphere are very different in character according as the different poles are used. For example: the spectrum of the air between mercury poles is very matt and undetermined; that obtained between platinum and aluminum poles is much more brilliant. Many of the lines in photographs of spectra of the air obtained in this way coincide, but many others do not, showing undeniably that the spectrum of one and the same substance may suffer by the presence of modifications which are very likely to arise. The changes in the spectrum of certain elements—as calcium, lithium, iron—which Lockyer ascribes to a decomposition of the elements, should therefore rather be attributed to the influence of foreign substances. The photographs which were obtained will appear, reproduced in lichtdruck, in the report of the Academy of Sciences.—*Dr. H. W. Vogel in Mittheilungen.*

According to a German authority (*Pharm. Zeitung*) a very handy sulphureted hydrogen apparatus may be made by putting into a large test tube, fitted with a cork and delivery tube, a mixture of equal weights of paraffine and sulphur. On applying heat hydrogen sulphide is given off, and on withdrawing the lamp the evolution of gas at once ceases, so that the same mixture may be used many times and will last for a long period.

PROPOSED NEW BRITISH POLAR EXPEDITION.

Our readers are probably aware, says the London *Graphic*, that an influential Central Committee has been formed, to which forty-nine provincial committees are affiliated, for the purpose of organizing an expedition to the North Pole on the plan recommended by Commander Cheyne, R. N., who is strongly of opinion that balloons will form an important element in all future Arctic explorations.

Our illustration depicts the three balloons as ready to start from the winter quarters of the ship during the first week in June, their destination being the North Pole. The average temperature in the early part of June is about 25° Fah. The balloons are named Enterprise, Resolute, and Discovery; each will be capable of lifting a ton in weight, the three carrying a sledge party intact, with stores and provisions for fifty-one days. The ascent will be made on the curve of a roughly ascertained wind circle, a continuation of which curve will carry them to the Pole, but should the said curve deflect, then the required current of air can again be struck by rising to the requisite altitude, as proved by experiments that different currents of air exist according to altitude; this fact Commander Cheyne himself observed when, in charge of the government balloons in his last expedition, he sent up four at the same moment to different altitudes; being differently weighted, they took four different directions to the four quarters of the compass, giving him his first practical idea of ballooning in the Arctic regions. Captain Temple's experiments with the war balloons from Woolwich Arsenal have fully confirmed this important desideratum in aerostation.

About thirty hours would suffice to float our aeronauts from the ship to the Pole, should all go well. We asked Commander Cheyne how he was going to get back; his answer was cautious: "According to circumstances," he said, "My first duty is to get there. When there leave it to us to get back. We have many uncertainties to deal with, and a definite programme made now might be entirely changed when the time came to carry out the journey south. Condensed gas would be taken in steel cylinders, hills would be floated over by expansion and contraction of the balloons, and in the event of any accident occurring, we always have our sledge party with sledge, boat, stores, and provisions for fifty days intact and ready for service." Scotland has taken up this novelty in Arctic exploration with avidity, and England, though more cautious in the matter, has at last given her adhesion to the project being carried out. Canada is likely to join, and Commander Cheyne has received an invitation from the Canadian Minister of Finance, Sir Samuel Tilley, K.C.B., to deliver his lectures in Canada, with the promise of a warm reception.

Atlantic Temperatures.

From the coast-station observations of the Weather Bureau it appears that the maximum temperature of the water in the months of July and August respectively is: At Jacksonville, Florida, 87·75 and 88·25 degrees; at Charleston, S. C., 86·00 and 87·25 degrees; at Wilmington, N. C., 85·50 and 83·50; at Norfolk, 81·00 and 82·25; at New London, Conn., 70·66 and 74·00; at Wood's Holl, Mass. (near Nantucket), 76·25 and 75·25; and at Portland, Me., 60·25 and 60·50 degrees. A very noticeable fact, apparently established by these data, is that the sea water bathing on the coasts and inlets all the way up to Portland is slightly warmer in August than in July, the greatest difference noted being found at New London, where the August temperature is three and a third degrees higher than that of the preceding month. If we tabulate all the observations from Jacksonville to Portland, the average temperature for July is 78·24 degrees, against 78·85 for August.

The lowest August temperatures of the water at Norfolk average 72·00 degrees; at New London, 65·25; and at Wood's Holl, Mass., 69·00. There are no reports for Cape Cod and the Jersey beach, but it is probably safe to assume that the waters on the latter are seldom, if ever, chilled below 70 degrees in August, and that on the east sides of Cape Cod and thence to Newport it is rarely that the August sea temperature falls below 69 degrees.

Timber in the English Colonies.

The English Government has been collecting information from the colonies as to their timber supply. It appears that during the five years ending 1876, Canada sent England about $125,000,000 worth of timber. In Nova Scotia the approximate amount of timber-producing land was, in 1875, computed at 9,000,000 acres; in Ontario, 30,000 square miles; in Quebec, 73,711,114 acres; New Brunswick, 6,000,000 acres. In British Columbia about 110,000,000 acres are covered with timber. Newfoundland, too, is densely wooded, but forest fires have there, as also to a considerable degree in Canada, made serious inroads. In Natal (Africa) the Crown forests have for some time been suffering so seriously from the depredations of the natives that the surveyor-general has absolutely prohibited the use of forest lands for the cultivation of crops.

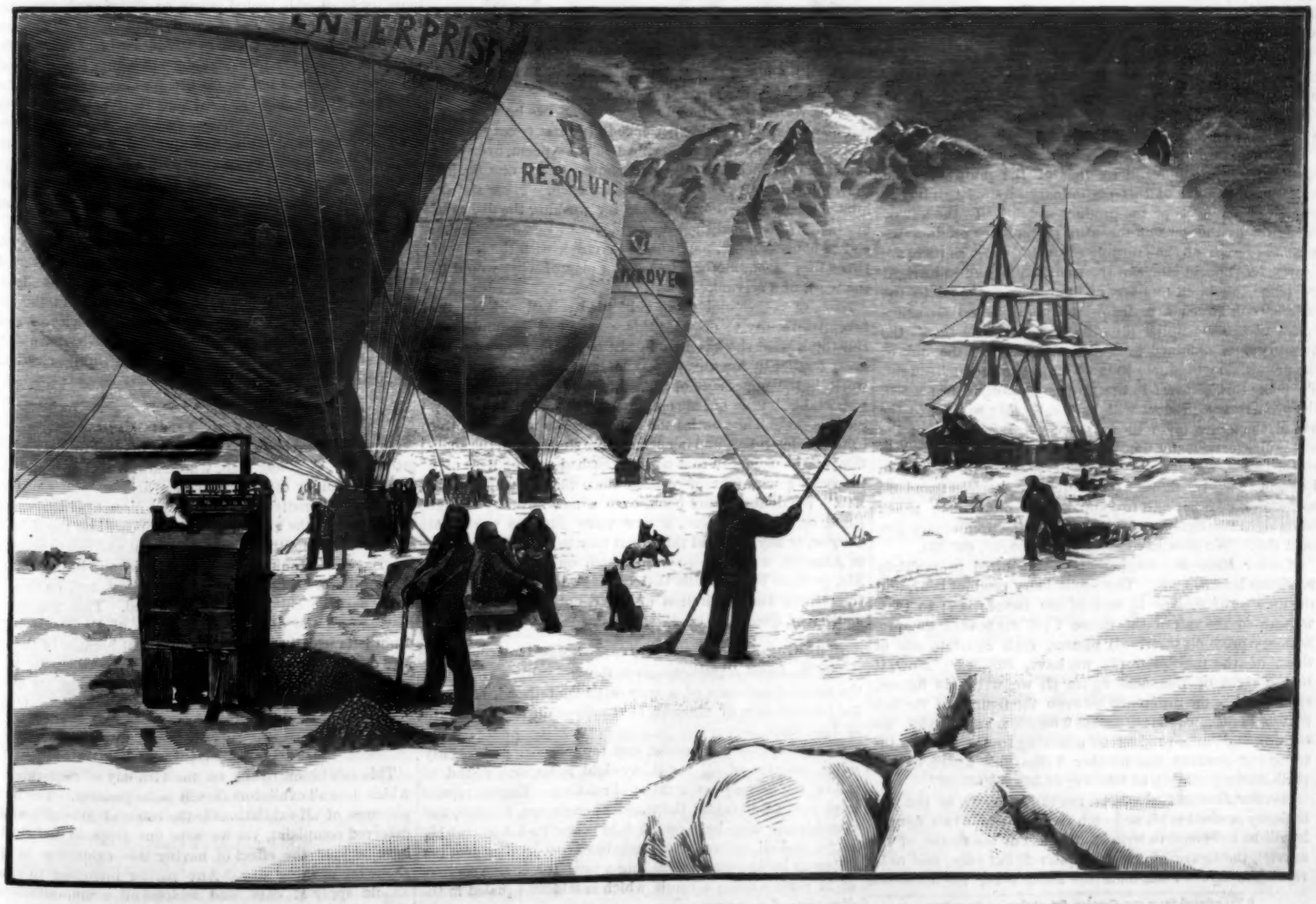
It is computed that Cape Colony has between 500 and 600 square miles of forest. Between 1868 and 1878 British Honduras sent 34,000,000 feet of mahogany. In Victoria, Australia, timber is diminishing far too rapidly, and in western Australia the Governor thinks that steps must be taken to arrest destruction. In Queensland an annual license fee is exacted from wood cutters, and an officer has been appointed to report on the public timber-producing lands, with a view to their conservation. Tasmania (Van Diemen's Land) has about 8,000,000 acres under timber, of which about 1,000,000 are in private hands. In Ceylon steps were some time since taken to arrest reckless destruction. In Queensland and South Australia the clearing of the forests has produced no effect whatever on the rainfall. In St. Helena, on the other hand, where the destruction of the trees shortly after colonization of the island was followed by a succession of severe and destructive droughts, now that the forests have been allowed to grow again there has been much less trouble on that score. The climate of Jamaica is reported much drier of late years in the south side of the island, where the greatest clearances have been made.

IODINE AS A SUBSTITUTE FOR QUININE.

The power possessed by iodine over malarial troubles seems to have been known many years ago, but the knowledge was evidently confined to few, and not appreciated as it ought to be. Recently several physicians have recorded their experience with this drug, and among others Dr. Wm. Anderson, who gives a highly favorable account of it in the *Proceedings of the Medical Society of the County of Kings*.

Dr. Anderson's experience with the remedy dates back about five years, when, meeting a statement that iodine was a reliable remedy in intermittent fevers, he resolved to give it a thorough trial. He therefore prescribed it in the form of the simple tincture to a number of patients. After watching the results very carefully, he became thoroughly convinced that he had a valuable remedy, and from that time to this he has invariably, with a few exceptions, prescribed iodine in all his cases of intermittent fever, both in private and dispensary practice. He states that up to the present time he has treated at least 300 cases in this manner, and with almost invariable success. The time required to effect a cure naturally varied. In a large number there was no paroxysm after the first dose; frequently it took two or three days before any mitigation was observed. Iodine is so seldom prescribed internally that most physicians look with suspicion on the idea of substituting it for quinine, and think that the stomach would not tolerate it. Dr. Anderson says that this mistaken notion is merely the result of inexperience; he has had but one patient who could not retain it, but neither could she retain quinine. He has found that children take it readily, and in giving it to such patients he has not had a fraction of the trouble that he formerly experienced with quinine. Although he formerly used simple tincture of iodine in sirup and water with good effect, he has recently found it advisable to add iodide of potassium to the mixture to prevent precipitation of the iodine. For adults he prescribes 12 to 15 minims of this compound tincture, freely diluted, to be taken three times a day after meals, and regardless of fever. For children, 5 to 10 minims usually suffice. The author's favorite prescription in private practice is: Tincture of iodine comp., 6 drachms; sirup of acacia, 18 drachms. Mix. Dose: teaspoonful in wineglassful of water three times a day, after food. Dr. Anderson states that he has never as yet observed any injurious effects from the internal exhibition of iodine, especially the symptoms designated as "iodism."

Why this drug should act so beneficially must remain an open question till we know more about the disease itself. It is worthy of note, however, that the remedies usually employed in malarial troubles have marked antiseptic proper-



PROPOSED NEW ARCTIC EXPEDITION.—COMMANDER CHEYNE'S PLAN FOR REACHING THE NORTH POLE.

ties, and this is a prominent trait of iodine. To the American physician, indeed to the inhabitants of all countries cursed by malarial fevers, this is a subject of unusual importance. It would be a national blessing to have an effective, safe, and cheap substitute for quinine; for, although the government has recently removed its protection from the latter, this action will affect not so much the pocket of the patient as that of the apothecary.

THREE RULES FOR ABBREVIATING MULTIPLICATION.*

(From the "Talkhys Amali al Hissab.")

The "Talkhys Amali al Hissab" ("Analytical Résumé of Calculating Processes"), written by Ibm al Banna, of Morocco, contains, in the chapter devoted to the multiplication of integral numbers, some abbreviated methods by means of which, in certain particular cases, the product of the multiplication of two integral numbers may be obtained very quickly. As these processes deserve to be known, and are not found in any arithmetical treatise (although the "Talkhys" gave them nearly six centuries ago), we publish them for the benefit of our readers.

FIRST RULE.—Suppose it be required to multiply by itself a number composed of figures, each equal to unity; for example, 11,111 × 11,111.

We say that the product will be, 123,454,321.

To obtain this we write the number of figures contained in one of the factors, and to the left and right of this number we place symmetrically the natural decreasing series of numbers less than it. Thus, in the example proposed we write down 5, that being the number of figures in one of the factors, and then we place on each side of that number the natural decreasing series of figures less than 5, that is, 4, 3, 2, 1, in the following form, 1234 5 4321.

Another Example.—Multiply 1,111,111 by 1,111,111. The product will be at once obtained by writing to the left and right of 7 (the number of figures contained in either of the two factors) the numbers 6, 5, 4, 3, 2, 1, as follows: 1,234,567,654,321. If we multiply 11 by 11, the application of the same rule will give as result, 121.

SECOND RULE.—To multiply by itself a number composed of figures, each equal to 9; for example, 99,999 by 99,999. We say that the product will be, 9,999,800,001.

To obtain this result, we write down the figure 8, placing to its left as many *nines*, and to its right as many ciphers, as there are figures less one, contained in either of the two factors, afterwards adding to the extreme right of the resulting number the figure 1. Thus, then, in the proposed example (99,999 × 99,999) we write the figure 8, and to its left the figure 9 repeated four times (5—1), and to its right four zeros (5—1), giving as a result 9999 8 0000; now annexing the figure 1, we obtain the product sought, 9,999,800,001.

Another Example.—If we desired to find the product of 9 by 9, we should obtain, by applying the general rule, 81. In fact, in this case, the number of figures of either factor, diminished by 1, gives zero as a result. This explains why the figure 8 does not appear accompanied by *nines* or cipher, but only by the figure 1 of the units.

THIRD RULE.—To multiply a number composed of figures each equal to 9, by another whose figures, although equal to each other, are different from 9; for example, 999 by 666.

In this case we say the product will be equal to 665,334.

To obtain this result, we first obtain the product of a figure of the multiplicand by that of the multiplier; the figure of the units of this preliminary product will be the number of the units of the product sought. To the left of the figure of the tens of the said preliminary product we write the figure of the multiplier as many times as there are figures, less one, in either of the two factors; and to its right we place the same number of figures, each equal to the difference between a figure of the multiplicand (9) and a figure of the multiplier (6). To the extreme left of the quantity thus obtained we annex the figure of the unit of the preliminary product; thus we have the product sought. To make this clearer: in the proposed example, 999 × 666, the preliminary product will be 9 × 6 = 54; so that, to the left of the figure (5) of the tens, we place the figure of the multiplier (6) as many times, less one, as there are figures in either factor, which in this case will be twice (3—1), and to its right twice the figure 3 (the difference between 9 and 6), as follows, 66 5 33; and to complete this number we annex to its right the figure (4) of the units of the preliminary product (54). We then have the product sought, 665,334.

Another Example.—Suppose it be required to multiply 9,999,999 by 3,333,333. The preliminary product is 27, and the number of figures in each of the factors is 7; so that, writing to the left of the figure 2 (of the tens of the preliminary product) six (7—1) figures, each equal to one of those of the multiplier (3), we have, 3333332. Now, if to the right of the same figure (2) we write six figures, each equal to the difference between the figures of the two factors (9—3), we have, 333333 2 666666; and finally, we obtain the definite product by annexing to the right of the foregoing quantity the number 7 (the unit figure of the preliminary product), as follows: 33,333,326,666,667.

Another Example.—If 99 be multiplied by 22, as the preliminary product is 18, and each factor contains two figures, it will be sufficient to write, to the left of the figure of the tens (1), the figure of the multiplier (2) but once, and to its right the figure 7 but once (the latter being the difference between 9 and 2); we will thus have 217, and to this we annex the number 8 (the unit of the preliminary product), and obtain the product sought, viz., 2,178.

This rule will hold good in all cases except those in which the factors contain each but a single figure. If, for example, we should apply the rule to the case 9 × 2, the preliminary product, 18, would at the same time be the final product. It is easy to see that the second rule may be considered as a particular case of the third—one in which the difference between the figure of the multiplicand and that of the multiplier is zero.

* Translated from the *Cronica Scientifica*, of Barcelona.

ENGINEERING INVENTIONS.

An engine valve, so constructed and arranged that the pressure of the steam upon the valve from above will be nearly or quite counterbalanced by the pressure from below has been patented by Lewis H. Baker, of Fairfield, Ill.

Mr. Jean L. Nevers, of Pass Christian, Miss., has patented in this country and in England an improvement in vibrating propellers, in which reciprocating propeller blades are employed, and the improvement consists in a novel device for controlling the propeller blades. In this propeller the change of direction is always under the immediate control of the person who has charge of the steering wheel, and though the motion of the engine may not cease, the positions of the blades can readily be changed at each stroke so that they will exert no force upon the water.

Mr. James H. Gray, of Connellsville, Pa., has patented an improved device for attachment to locomotive, marine, and other engines, to operate them by compressed air. The invention consists in a series of air drums, arranged at some distance apart in the water tank of a steam engine, connected together by pipes, and communicating with suitable pumps operated by the engine, and connected by a pipe along the outside of boiler with the steam chest and cylinders.

Mr. James H. Gray, of Connellsville, Pa., has patented a direct acting pump, in which a steam or water pump and steam cylinder are operated in connection with a single piston. The invention consists in an improved construction of valves, by which a steam chest is dispensed with and the pump is rendered cheap and effective.

A switch bar, having jaws which are adjustable lengthwise of the switch bar so that they may be moved to fit the rail, and the rails and jaws shifted to the desired gauge, has been patented by Mr. William K. Dunwoody, of Eagle Mills, Mich.

Bearing Fruit.

Twenty-five years ago we went to the wedding reception of a charming and brilliant young woman from a New England State, just married to a young physician in a Western city. She had come from the best schools, and was the woman, of all others, who was looked at as a leader in the higher literary and artistic life of a prominent circle in the town. Seven years ago we again met that woman, now a matron of forty-five, in a Western university town, where her husband had finally landed as a professor of sciences in the college. We saw that the family were living in quiet and simple elegance on the small salary of a Western professor, with a house full of fine children, and no servant that we could discover.

At tea we ventured the question, "What has been the result of your studies and experience in the last twenty years? I have seen no book, or magazine article, or poem, over your name, as we expected." "I will show you my one book," she replied, leading the way to her kitchen. There she exhibited a most ingenious machine for washing the dishes of her table, which abolished the drudgery of this disagreeable end of housekeeping, and enabled a child, with the help of two "lifts" from mother, to make a play of what would be the work of a servant.

Now, of course, not every cultivated school girl has the inventive faculty to do what this woman had accomplished. But think what she has done! She has made it possible for every mother in America to save an hour a day for study, or work, in the upper side of life. She has made it not only a respectable, but an artistic employment to wash table dishes. She has made home duties and housekeeping more attractive to all her daughters, and taken one more step toward the abolition of the drudgery that has so crushed out the lives of a thousand generations of women since the days of mother Eve. We doubt if any book, even a new novel by George Eliot, or a new picture, a new voice like the warble of Gerster, or any splendid thing that may be done by a woman in America, would go so deep, touch on higher realms of life, or more justly entitle that cultivated Christian lady to the respect and admiration of the country.—*New England Journal of Education.*

Running Expenses of Narrow Gauge Railroads.

The St. Louis *Republican* gives the following estimate of the running expenses of a narrow gauge railroad, based on the performance of nineteen locomotives during the month of June last:

The locomotives consume one ton of coal per seventy miles, one pint of oil for thirty-eight miles, one pound of tallow for seventy-seven miles of running. Engine repairs have cost 4 3-10 cents; the wages of engineers, firemen, and round-house men have cost 5 9-10 cents; fuel has cost 1¼ cents; and oil, tallow, and waste have cost ¼ of a cent per mile run by the engines, making a total for engine services of 12 cents a mile; a result which is seldom equaled in the direction of economy.

Memoranda for Disinfecton of Yellow Fever.

The following rules have been published by the National Board of Health:

1. It is prudent to assume that the essential cause of yellow fever is what may, for conciseness, be called a "germ," that is, something which is capable of growth and propagation outside the living human body; that this germ flourishes especially in decaying organic matter or filth, and that disinfection must have reference both to the germ and to that in or on which it flourishes.

2. Disinfection, when used in a place not infected, for the purpose of rendering filth, or foul soils, waters, etc., incapable of propagating disease germs, is a poor substitute for cleanliness, and is mainly useful to make the process of cleansing odorless and harmless. The best disinfectants for this purpose are sulphate of iron, carbolic acid, fresh quicklime, fresh charcoal powder, chloride of zinc, chloride of aluminum, and permanganate of potash.

3. The two great difficulties in destroying the vitality of the germ of yellow fever are, first, to bring the disinfecting agent into actual contact with the germ; and, second, to avoid injuring or destroying other things which should be preserved.

4. *When the germ of yellow fever is dry, or partially dried, no gaseous disinfectant can be relied on to destroy it.* It must either be moistened or subjected to a dry heat of not less than 250° F., to obtain security.

5. In disinfecting or destroying infected clothing, bedding, or movable articles, *move them as little as possible while dry.* Before disturbing them have them thoroughly moistened, either with a chemical disinfecting solution or with boiling water, in order to prevent the diffusion of dried germs in the air in the form of dust.

6. The best method of disinfecting rooms, buildings, ships, etc., is still doubtful, owing to the difficulty of destroying the vitality of dried germs.

The Board proposes to have this subject carefully investigated, and in the meantime advises thorough scrubbing and moist cleansing, to be followed by the fumes of burning sulphur, at the rate of 18 ounces per 1,000 cubic feet of space to be disinfected.

The sulphur should be broken in small pieces, burned over vessels containing water or sand, which vessels should be distributed in the closed space to be disinfected at the rate of one to each 100 square feet of area of floor.

7. No patented compound known to the Board is superior, as a disinfectant, to the agents above mentioned, and none is so cheap. Some of these patent disinfectants are good deodorants, but *the removal of an unpleasant odor is no proof that true disinfection has been accomplished.*

8. In districts where yellow fever prevailed last year the following precautionary measures should be taken:

(*a*) Textile fabrics of every description which were exposed to yellow fever infection during the year 1878, and which have remained packed or boxed in a closed space since such exposure, should not be opened or unrolled, but should either be burned or placed in boiling water for half an hour or more, or in suitable heated ovens, or disinfected, according to the nature and value of the individual article or articles.

(*b*) Every house or room in which cases of yellow fever occurred in the year 1878, and since that time have remained unoccupied, should not be opened for occupation until they have been thoroughly cleansed and disinfected, by persons acclimated to yellow fever.

(*c*) Every privy, vault, underground water cistern, dry well, or closed cellar, connected with a house in which yellow fever existed last year, and which may not have been opened since that date, should not be reopened, but if possible should be covered with several feet of earth.

(*d*) Every suspicious case of sickness should be at once isolated, and every possible precaution taken to prevent infection, by providing attendants who have had the disease, and thorough disinfection of all discharges from the sick. If the disease prove to be yellow fever, all articles of clothing and bedding used about the sick should be burned, the house should be vacated, and every room tightly closed and fumigated with burning sulphur.

A New Way to Treat Diphtheria.

Quite a discovery in the treatment of diphtheria has been made here. A young man, whose arm had been amputated, was attacked by diphtheria before healing took place, and instead of the matter incident to that disease being deposited in the throat, the greater portion appeared on the wounded arm, and the diphtheria was very light and easily managed. Dr. Davis, of Mankato, profited by this, and in his next case of diphtheria blistered his patient's chest, and on this blistered part the chief deposits appeared. This was also an easy case of the disease. The theory of Dr. Davis is that diphtheria usually appears in the throat because of the thinness of the lining of the throat. Hence, when the blister breaks the skin upon any other part of the body, the disease appears there.—*Minnesota letter to the Salem (Mass.) Gazette.*

American Institute Exhibition.

This exhibition opens on the 17th day of September, by which date all exhibitors should be in position. The incompleteness of all exhibitions is the cause of general and well deserved complaint, yet we hope our frequent notices may have at least the effect of having this exhibition in good shape on opening day. Any parties intending to exhibit should apply at once, and address all communications to General Superintendent, American Institute, New York city.

The Silver Mines of Arkansas.

A correspondent of the St. Louis *Globe-Democrat*, writing from Little Rock, describes the mining region of Montgomery county and its minerals as follows:

The district embraces townships 1 and 2 south, ranges 23, 24, 25 west, which includes a district of about 216 square miles.

The main water courses are the Wichita proper, and its south and north forks, besides a large number of small streams and rivulets, all more or less suitable for water power. The same tract of land is well timbered with yellow pine, white and black oak, ash, hickory, black walnut, gum, etc., well adapted for building and mining purposes.

The district forms a basin of small rolling hills, which are continuous throughout its entire length, and is surrounded by the Ozark Mountains on the north, the Mazerne Mountains on the south, the eastern spur of the Cassotal and Little Missouri Mountains on the west, and the Crystal Mountains on the east. These mountains are of secondary and primary formation, containing hornblende, granite, slate, and porphyry.

South of the Mazerne range is a younger formation of novaculate and limestone. The summits of the Crystal Mountains show ledges of metamorphic sandstone, underlaid by slate and sub-carboniferous limestone, which leads to the conclusion that this entire mineral belt is underlaid by sub-carboniferous limestone and porphyry.

The basin itself shows calcous shale and slate—the latter being generally exposed in the gulches and river banks—and is traversed by a belt of quartz veins which runs in an eastwardly and westwardly direction, and can be followed westwardly its entire length through the Cassotal range to the Indian Territory, thence through the Wichita Mountains, in the northwest part of Texas, striking the Rocky Mountains in New Mexico, the belt showing the same formation throughout its entire length, which has been conclusively proven by many of our most eminent geologists and mining engineers who have spent years of time and labor in determining this important fact, and who offer as an evidence of the correctness of this view the fact that the same minerals exist in the same character of quartz and spar throughout both entire districts.

The veins opened up to the present time have given evidence of walls and selonge, and are the quartz veins freely impregnated by gouche, which dip north, and have more or less strong overlap south, and have a general strike from 8° to 25° north of east.

The eminent geologists, Professors Church and Phillips, during their stay in Silver City, made upward of thirty assays, with the most gratifying results, the quartz with two exceptions ranging from 200 to 600 ounces of silver to the ton, and this from specimens picked up indiscriminately from the surface, and in which not the slightest indication of ore was perceptible. These gentlemen were astonished to find such results from quartz that made no showing whatever, and was in no case taken from a greater depth than twenty feet, which was hardly sufficient to enable them to determine with any degree of accuracy the extent or value of the ores of greater depth, but gave it as their opinion that their greatest richness would be at a depth of one hundred and fifty feet.

Prof. Phillips, who was in Mexico in the months of September, October, and November, examined a large number of old silver mines in Chihuahua and Durango, and who has been four months in Arkansas examining its silver resources, states that the two fields, in their general geology, are almost identical in character, and feels convinced that these high grade ores from the quartz veins of Montgomery county will run to wire and other forms of native silver at a depth of 100 to 200 feet, as similar surface ores were found in the same character of quartz incased in slates as were mined by the old Spaniards at Parral, Santa Barbara, and Inde, in the State of Durango, and all of which veins carried more or less native silver at a depth not exceeding 100 feet from the surface.

PAPER is worth six cents a pound in Peru until it is made into money, then it depreciates, adds a wicked editor next door, about fifty per cent.

GOTHIC OAK PRESS.

The carved oak press, with metal work after the style of the close of the 15th century, is an admirable specimen of its class. It is now in the possession of the Art Industry School of Vienna, and is preserved as a good example of fine Gothic carved work.

CARVED OAK PRESS.—AFTER THE STYLE OF THE 15TH CENTURY.

RECENT AGRICULTURAL INVENTIONS.

Mr. William H. Sterns, of Humboldt, Neb., has patented a simply constructed and easily operated churn, in which the agitation of the cream is produced by the rapid movement of the apparatus in a horizontal plane, so that the cream is thrown violently from side to side of the receptacle, a circular or rotary movement being prevented by cream breakers in the sides of the receptacle.

An improvement in corn planters has been patented by Mr. Allen F. Hall, of Onarga, Ill. The object of this invention is to improve the construction of the corn planter for which letters patent No. 197,549 were granted to the same inventor, November 27, 1877, so as to make it simpler in construction, more easily operated, and more readily thrown into and out of gear.

An economical and powerful press for cotton, hay, rags, etc., that may be worked by hand, horse, or steam power, in field, farm, or factory, has been patented by Mr. John Rossell, of Galveston, Texas. The invention consists in combining worm gearing with an eccentric cam for working the movable head of the press, and in a novel arrangement of pins and an endless rope for retracting the movable head.

Mr. Thomas T. Harrison, of Aubrey, Kan., has invented an improved attachment for breaking and cultivating plows, by which the plow can be easily and fully controlled. The invention consists in a novel arrangement of vertical and horizontal bars for supporting and guiding the plow.

The General Wool Monument.

The largest monolith ever transported any distance in this country is the granite shaft to be set up in honor of Major-General John Ellis Wool, at Troy, N. Y. It is of gray granite, measures 3,784 cubic feet, and weighs 254 tons. In the rough it measured 4,763 cubic feet, and weighed 398 tons. The entire monument will stand 78 feet 7 inches high, the shaft alone measuring 58 feet. The stone was cut and finished at the quarry of the Bardwell Granite Company, Fox Island, Maine. This monolith is considerably smaller than the obelisk known as Cleopatra's Needle, lately transported from Egypt to London. The great Lateran obelisk in Rome, originally from the Temple of the Sun, in Egypt, is 150 feet high and weighs 440 tons.

The Swiftest Ship in the World.

A new British war steamer, called the Mercury, built of steel, has just been completed and successfully tried at Portsmouth, England. The vessel is 300 feet long, 45 feet beam, 16 feet 3 inches hold. Displacement, 3,750 tons. On her late trial trip the engines developed 7,595 horse power, and the speed attained was within a trifle of 22 miles an hour. These are remarkable results for a vessel of the dimensions given. The Mercury has twin screws, driven by separate engines arranged in separate engine rooms. Her machinery nearly fills the hull. There are twelve boilers, four high pressure cylinders, each 41 inches diameter, and four low pressure cylinders, 75 inches diameter. Stroke, 3 feet; boiler pressure, 60 to 65 lb.; coal consumption, 2·35 lb. per hour per horse power. One man governs the rudder, which is worked by steam. The vessel's armament will consist of ten 64-pounders.

Two More New Metals.

The discovery of two new metals is announced, named samarium and norwegium. Paradoxical as it may sound to speak of the finding and christening of a hitherto unknown metal before it has been either seen or handled, yet such is the case with samarium. As happened in the instance of the metal gallium, mentioned in the SCIENTIFIC AMERICAN a few numbers back, it has first become known to science by means of the spectrum analysis alone; nor can it be doubted, predicts one of our foreign exchanges, that in the verification of its existence by the senses it will, in due time, follow the same precedent. It is well known that by means of the characteristic rays which are seen in the luminous spectrum, produced by the combustion of any substance, it is possible to single out the known or unknown bodies which enter into the combination. As are the rays, such are the elements producing them. When rays are found answering to no substance already catalogued, the existence of some new body is naturally inferred from the fact. That was how gallium was first brought to light, and now we have a like history for samarium. M. Lecoq de Boisbaudran, who has greatly distinguished himself by his researches in this branch of science, found, as he was examining a mineral known under the name of samarkite, an emission of unfamiliar rays. He has inferred thence the existence in this mineral of a new metal, which he has accordingly named samarium, and all he has now to do is to isolate it from the other elements with which it is as yet combined. This has already been done for another new metal, norwegium, patriotically so named after his fatherland by its discoverer, Professor Tellef-Dahll, of the University of Norway, who detected it in a metallic compound of arsenic and nickel. The professor has even determined the principal properties of this new metal, which he describes as being white, slightly malleable, of about the hardness of copper, and fusible at a dull red heat. Its density is represented by 9·44, and its chemical equivalent is 145.

Heating Metals in Vacuo by the Electric Current.

A very interesting paper, by Mr. T. A. Edison, was read before the American Association at Saratoga the other day:

"In the course of my experiments on electric lighting," says the author, "I have developed some striking phenomena arising from the heating of metals by flames and by the electric current, especially wires of platinum and platinum alloyed with iridium. These experiments are still in progress.

"The first fact observed was that platinum lost weight when heated in a flame of hydrogen, that the metal colored the flame green, and that these two results continued until the whole of the platinum in contact with the flame had disappeared.

"A platinum wire, twenty-thousandths of an inch in diameter, was wound in the form of a spiral one eighth of an inch in diameter and half an inch in length. The two ends of the spiral were secured to clamping posts, and the whole apparatus was covered with a glass shade. Upon bringing the spiral to incandescence for twenty minutes that part of the globe in line with the sides of the spiral became slightly darkened; in five hours the de-

posit became so thick that the incandescent spiral could not be seen through the deposit. This film, which was most perfect, consisted of platinum, and I have no doubt but that large plates of glass might be coated economically by placing them on each side of a large sheet of platinum, kept incandescent by the electric current. This loss in weight, together with the deposit upon the glass, presented a very serious obstacle to the use of metallic wires for giving light by incandescence, but this was easily surmounted after the cause was ascertained. I coated the wire forming the spiral with the oxide of magnesium by dusting upon it finely powdered acetate of magnesium. While incandescent the salt was decomposed by the heat, and there remained a strongly adherent coating of the oxide. This spiral so coated was covered with a glass shade and brought to incandescence for several minutes; but instead of a deposit of platinum upon the glass there was a deposit of the oxide of magnesia. From this and other experiments I became convinced that this effect was due to the washing action of the air upon the spiral; that the loss of weight in and the coloration of the hydrogen flame was also due to the wearing away of the surface of the platina, by the attrition produced by the impact of the stream of gases upon the highly incandescent surface, and not to volatilization, as commonly understood.

"I will now describe other and far more important phenomena observed in my experiments.

"If a short length of platinum wire, one thousandth of an inch in diameter, be held in the flame of a Bunsen burner, at some part it will fuse and a piece of the wire will be bent at an angle by the action of the globule of melted platinum; in some cases there are several globules formed simultaneously, and the wire assumes a zigzag shape.

"With a wire four thousandths of an inch in diameter this effect does not take place, as the temperature cannot be raised to equal that of the smaller wire owing to the increased radiating surface and mass. After heating, if the wire be examined under a microscope, that part of the surface which has been incandescent will be found covered with innumerable cracks. If the wire be placed between clamping posts, and heated to incandescence for twenty minutes by the passage of an electric current the cracks will be so enlarged as to be seen with the naked eye, the wire under the microscope presents a shrunken appearance, and is full of deep cracks. If the current is continued for several hours these effects will so increase that the wire will fall to pieces.

"This disintegration has been noticed in platina long subjected to the action of a flame, by Prof. John W. Draper. The failure of the process of lighting invented by the French chemist, Tessié-du-Motay, who raised sheets of platinum to incandescence by introducing them into a hydrogen flame, was due to the rapid disintegration of the metal. I have ascertained the cause of this phenomenon, and have succeeded in eliminating that which produces it, and in doing so have produced a metal in a state hitherto unknown, and which is absolutely stable at a temperature where nearly all substances melt or are consumed; a metal which, although originally soft and pliable, becomes as homogeneous as glass and as rigid as steel. When wound in the form of a spiral it is as springy and elastic when at the most dazzling incandescence as when cold, and cannot be annealed by any process now commonly known.

"For the cause of this shrinking and cracking of the wire is due entirely to the expansion of the air in the mechanical and physical pores of the platinum, and the contraction upon the escape of the air. Platinum as sold in commerce may be compared to sandstone in which the whole is made of a great number of particles with many air spaces. The sandstone upon melting becomes homogeneous and no air spaces exist. With platinum or any metal the air spaces may be eliminated and the metal made homogeneous by a very simple process. This process I will now describe. I had made a large number of platinum spirals, all of the same size and from the same quality of wire; each spiral presented to the air a radiating surface of three and one sixteenths of an inch; five of these were brought by the electric current up to the melting point, the light was measured by a photometer, and the average light was equal to four standard candles for each spiral just at the melting point. One of the same kind of spirals was placed in the receiver of an air pump and the air exhausted to two millimeters; a weak current was then passed through the wire to warm it slightly for the purpose of assisting the passage of the air from the pores of the metal into the vacuum. The temperature of the wire was gradually augmented at intervals of ten minutes until it became red. The object of slowly increasing the temperature was to allow the air to pass out gradually and not explosively. Afterward the current was increased at intervals of fifteen minutes. Before each increase in the current the wire was allowed to cool, and the contraction and expansion at these high temperatures caused the wire to weld together at the points previously containing air. In one hour and forty minutes this spiral had reached such a temperature without melting that it was giving a light of twenty-five standard candles, whereas it would undoubtedly have melted before it gave a light of five candles had it not been put through the above process. Several more spirals were afterward tried, with the same result. One spiral which had been brought to these high temperatures more slowly gave a light equal to thirty standard candles. In the open air this spiral gave nearly the same light, although it required more current to keep it at the same temperature.

"Upon examination of these spirals, which had passed through the vacuum process, by the aid of a microscope, no cracks were visible; the wire had become as white as silver, and had a polish which could not be given it by any other means. The wire had a smaller diameter than before treatment, and it was exceedingly difficult to melt in the oxyhydrogen flame, as compared with untreated platinum; it was found that it was as hard as the steel wire used in pianos, and that it could not be annealed at any temperature.

"My experiments with many metals treated by this process have proved to my satisfaction, and I have no hesitation in stating, that what is known as annealing of metals to make them soft and pliable is nothing more than the cracking of the metal. In every case where a hard drawn wire had been annealed a powerful microscope revealed myriads of cracks in the metal.

"Since the experiments of which I have just spoken, I have, by the aid of Sprengel mercury pumps, produced higher exhaustions, and have, by consuming five hours in excluding the air from the wire and intermitting the current a great number of times, succeeded in obtaining a light of eight standard candles from a spiral of wire with a total radiating surface of 1-32 of an inch, or a surface about equal to a grain of buckwheat.

"With spirals of this small size which have not passed through the process the average amount of light given out before melting is less than one standard candle. Thus I am enabled by the increased capacity of platinum to withstand high temperatures, to employ small radiating surfaces, and thus reduce the energy required for candle-light. I can now obtain eight separate jets, each giving out an absolutely steady light, and each equal to sixteen standard candles, or a total of one hundred and twenty-eight candles, by the expenditure of thirty thousand foot pounds of energy, or less than one horse power.

"As a matter of curiosity I have made spirals of other metals, and excluded the air from them in the manner stated. Common iron wire may be made to give a light greater than platinum not heated. The iron becomes as hard as steel and just as elastic. Nickel is far more refractory than iron. Steel wire used in pianos becomes decarbonized, but remains hard and assumes the color of silver. Aluminum melts only at a white heat."

Economy of the Electric Light.

Further experiments with the electric light on the Thames Embankment, London, indicate that the light may be produced at less cost than appeared possible at the time when only 20 lights were in circuit. It will be remembered, says the *Electrician*, that the engine employed is of 20 horse power nominal, manufactured by Messrs. Ransomes, Sims & Head, and that the Jablochkoff lights are used. Operations were commenced at the end of last year, the engine driving 20 lights, indicating about 23 horse power, and consuming 3·8 lb. of coal per indicated horse power per hour Six months afterward a second Gramme exciter and divider were added for lighting 40 lights, when the engine indicated about 38 horse power, and the consumption of fuel was about 3·2 lb.

Last month a lengthened experiment was made, in order to test whether the engine was capable of driving three exciters and three dividers for supplying light to 60 candles through a circuit of nearly a mile and a half, and it was found that with an indicated power of about 60 horses, and making 140 revolutions per minute, the engine was completely master of the work, and the 60 lights burned more steadily than when the smaller number were driven. As the consumption of fuel will not probably exceed 3 lb. per indicated horse power when working 60 lights, and the working charges will be about the same as when the experiments were made upon which Mr. Keates founded his report respecting the cost of 20 lights, it seems evident that the cost of electric lighting may be reduced by existing machinery and appliances to something not greatly in excess of that of gas.

The Fourth of July under the Midnight Sun.

A party of Americans celebrated the 102d anniversary of our national independence at North Cape, Norway, latitude 71° 15′, longitude 25° 50′. They arrived there at 11 o'clock on the night of July 3d, and at one minute after midnight guns were fired and the shrill sounds of the engine's whistle were made to respond to the number of stars on our flag, and loud cheers given to usher in our great national holiday. The party then ascended the almost perpendicular cliff (900 feet high) and raised the American flag, the flag being made for the occasion by the ladies of the party out of materials purchased at one of the Norwegian towns. When the flag was raised cheers and guns again resounded over the waters. It was certainly a most extraordinary place for such a celebration—probably the first time that a party of Americans ever celebrated the Fourth of July at such an hour and at such a latitude and longitude. The midnight sun shone upon them all the time with dazzling brightness. Far to the north they gazed out on the Atlantic Ocean dashing against the great cliff on which they stood. Behind them were the snow-clad mountains, along which they had been coasting, and not a living creature was near them but the sea birds that arose screaming from the water as the silence of their home was broken. The North Cape is beyond seventy-one degrees of north latitude and about 100 miles north of Hammerfest, the most northerly town in the world. It is five degrees further north than the most northern part of Iceland.

Invisible Spines of the Cactus.

I landed one day on one of the small outliers of St. Thomas, Little Saba Island, about a mile and a half distant from the main island.

A puffin (*Puffinus sp.*) was nesting in holes among the grass, laying a single large white egg. The birds allowed themselves to be caught in the nest with the hand. Our spaniels kept bringing them to us, retrieving them with great delight.

The island was covered with thorny cactuses. It was impossible to avoid their prickles, and I got covered with them when in pursuit of wild goats and pigeons. There were four kinds of cactuses: a prickly pear (*Opuntia*), with spines ¾ of an inch long; a quadrangular stemmed cactus, like the most familiar one in greenhouses; a cactus with rounded ribbed stem, growing in candelabrum-like form (*Cereus*); and a large dome-shaped cactus, a foot and a half high, and bearing a crown of small red flowers (*Melocactus*).

The spines must be a most efficient protection to the cactus from being devoured by large animals. I have often noticed that if one approaches one's hand slowly toward some of the forms with closely set long spines, doing it with especial care, to try and touch the end of one of the spines lightly without getting pricked, one's hand always does receive a sharp prick before such is expected, the distance having been miscalculated.

There seems to be a special arrangement in the color of the spines in some cases, possibly intended directly to bring about an illusion, and cause animals likely to injure the plant to get pricked severely before they expect it, and thus to learn to shun the plant.

While the greater length of the spines next the surface of the plant is white, the tips are dark colored or black. The black tips are almost invisible, as viewed at a good many angles against the general mass as a background. The spines look as if they ended where the white coloring ends, and the hand is advanced as if the prickles began there and is pricked suddenly by some unseen black tip. The experiment is easily tried in any cactus house at home.—*Notes by a Naturalist—Moseley.*

Fusible Metals.

Of mixtures of metals which become liquid at temperatures at or below the boiling point of water, there are several known, some of which are placed in convenient order as follows:

1. D'Arcet's: Bismuth, 8; lead, 5; tin, 3 parts. This melts below 212° Fah.

2. Walker's: Bismuth, 8; tin, 4; lead, 5 parts; antimony, 1 part. The metals should be repeatedly melted and poured into drops, until they can be well mixed previous to fusing them together.

3. Onion's: Lead, 3; tin, 2; bismuth, 5 parts. Melts at 197° Fah.

4. If, to the latter, after removing it from the fire, one part of warm quicksilver be added, it will remain liquid at 170° Fah., and become a firm solid only at 140° Fah.

5. Another: Bismuth, 2; lead, 5; tin, 3 parts. Melts in boiling water.

Nos. 1, 2, 3, and 5 are used to make toy spoons to surprise children by their melting in hot liquors. A little mercury (as in 4) may be added to lower their melting points.

Nos. 1 and 2 are specially adapted for making electrotype moulds. French cliché moulds are made with the alloy No. 2. These alloys are also used to form pencils for writing, also as metal baths in the laboratory, or for soft soldering joints.

Direct Determination of Silver in Galena on Volhard's Principle.

From two to five grammes of the galena, according to its supposed richness in silver, are very finely ground and intimately mixed in a porcelain mortar with from three to four times its weight of a flux composed of equal parts of soda and saltpeter, placed in a porcelain crucible, covered, and heated over a burner to thorough fusion, when the mixture is well stirred with a glass rod. It is then let cool and placed in an evaporating dish partly filled with water, in which the melted matter is softened, dissolved out of the crucible into the dish, which is then heated, and the watery solution is filtered into a flask. The residue on the filter, after being well washed, is rinsed back into the dish, very dilute nitric acid is added, and the whole evaporated to dryness. The dry residue is taken up in water acidulated with nitric acid, heated, and filtered into the same flask in which is the aqueous solution. The residue is washed with hot water, the filtrate is allowed to cool in the flask, ferric sulphate or iron alum is added, and the liquid is titrated.—*C. A. M. Balling, in Oest. Zeitschrift Berg. u. Hütten.*

THE Royal Kew Gardens were recently devastated by a severe hail storm, which broke glass in the conservatory to the estimated number of 16,000 panes. The hailstones were found to average one and a half inches in diameter, and to weigh three quarters of an ounce. They came down with sufficient force to bury themselves in the bare earth of the flower borders, and even penetrate the turf to the depth of an inch. In some cases perfectly circular holes were cut out of the glass panes, while the hailstones went through the succulent leaves of the Echeverias planted out in the beds with as clean an outline as if it had been made with a punch.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

THE NEW YORK HERALD WEATHER SERVICE. 1877-78-79. 8vo, paper, pp. 34.

This pamphlet sketches the development of the *Herald* Weather Bureau, and gives a list of the storm warnings cabled by it to Europe and the manner of their fulfillment, with other cognate information.

GEOLOGICAL SURVEY OF KENTUCKY. N. S. Shaler, Director.

The late publications of this survey embrace the following: Iron: the impurities which commonly occur with it, and their effects. By Wm. B. Caldwell, Jr. Report on the Limonite Ores of Trigg, Lyon, and Caldwell Counties. By Wm. B. Caldwell, Jr. Notes on the Yellow Fever Epidemic, at Hickman, Ky., during the summer and autumn of 1878. By John R. Proctor.

ANALYSES OF THE SUGAR QUESTION. By Henry A. Brown. Saxonville, Massachusetts. Paper, pp. 42.

Mr. Brown, formerly Special Treasury Agent of the United States, discusses the very complex sugar question as an expert, and reaches the conclusion that the present sugar tariff ought to be modified. By making the following "moderate changes" he believes that the consumption of sugar would be enormously increased, while the revenue from sugar food would still be ample, without injuriously affecting any public or national interest: First, the classification of melado as not above No. 7 Dutch standard sugar. Second, abolish the additional 25 per cent ad valorem on all sugar. Third, strike out the words "after being refined" in the section relating to colored sugars. Fourth, all sugars under No. 10 D. S. in color, containing 92 per cent or more of crystallizable sugar, to pay the same duty as sugars above No. 10 and not above No. 13 D. S. in color.

PROCEEDINGS OF THE ENGINEERS' CLUB OF PHILADELPHIA. Edited by Charles E. Billin. Vol. I., Nos. 1 and 2.

No. 1 of this new journal embodies the principal papers and more important topics of discussion brought before the club during its first year. No. 2 covers the proceedings of the fore part of the current year. The club starts off with vigor, and the character of the papers presented justifies the hope, if not the prediction, that it will live long and prosper. The proceedings are published at the rooms of the club, No. 10 North Merrick street, Philadelphia.

LIFE AND WORK OF JOSEPH HENRY. By Frank L. Pope. New York: D. Van Nostrand. 12mo, paper, pp. 31.

This puts in an attractive and keepable form Mr. Pope's sketch of the life and discoveries of Professor Henry (having special reference to the development of the electric telegraph), first printed in the Journal of the American Electrical Society.

DARWINISM AND OTHER ESSAYS. By John Fiske. London and New York: Macmillan & Co. 12mo. Price $2.

The dozen detached essays here brought together are well worth preserving. Mr. Fiske is always outspoken, bright, and suggestive; and he has a happy faculty of seizing upon and setting plainly forth the vital points of a critical discussion. Several of the essays have a historical rather than an immediate interest to those who have kept up with the drift of recent thought; still as a part of the literature of evolution they are worth keeping. The book is well made and has a good index.

HINTS TOWARD A NATIONAL CULTURE FOR YOUNG AMERICANS. By S. S. Boyce. New York: E. Steiger. Price 25 cents.

We should be glad to see this little work (little in size but great in spirit and promise) in the hands of every American parent, teacher, and pupil. It is too much to hope that the traditions of the schools can be displaced by the spirit of true, practical, scientific, and industrial culture, without the waste and misdirection of a large portion of the childhood of many generations. But we believe that the good time is coming, though remote, and the general circulation of Mr. Boyce's Hints would do much to hasten it. The hints to young men on self culture and on growth by culture, are especially sensible and valuable.

TEACHER'S HAND BOOK TO ACCOMPANY AVERY'S ELEMENTS OF NATURAL PHILOSOPHY. New York: Sheldon & Company. 1879.

This little book is chiefly remarkable for the proper emphasis it lays upon the truth that no science teacher can hope to do justice to his work without keeping a constant watch upon the current literature of science. The progress of discovery is so rapid that the most carefully prepared treatise is liable to become deficient in essential particulars before it is published. It may be "up to date" when it goes to press, and antiquated when it leaves the bindery; and the teacher who trusts entirely to his text books is not only sure to be behind the time in the matters of technical information, but is also necessarily lacking in general knowledge, in practical intelligence, and in that affluence of every day facts and suggestions which the true teacher must possess.

ÆSOP'S FABLES. Printed in pronouncing orthography. Published by C. W. Knudsen. South Norwalk, Conn.

Forty fables from the versions of the Rev. Thomas James and Mary Godolphin, printed phonetically to show the application of the English Demotic Alphabet, and to call attention to the spelling reform movement. Though of the opinion that none of the alphabets yet suggested will be the accepted one when English print becomes phonetic, as it is sure to be sooner or later, we believe that efforts like Mr. Knudsen's should be encouraged. They tend to familiarize the rising generation with phonetic print, and thus indirectly break down the absurd prejudice that prevails in favor of our current misspelling, simply because it is familiar.

SEARCY'S LESSONS IN PHONOGRAPHY. By W. E. H. Searcy. Philadelphia: J. B. Lippincott & Co.

The author, a practical law reporter, offers his book as a contribution to the common cause of phonography. He has drawn his material from all available phonographic sources, and claims to have stripped the subject of all unnecessary mockery and useless verbiage, retaining only such principles and introducing such "improvements" as seem to him needful for the work of verbatim reporting. How far he has succeeded in his aim it is impossible to say without mastering a multitude of books and other stenographic devices, which seem to one practically familiar only with Pitman's system, as fearfully numerous.

SCIENCE LECTURES AT SOUTH KENSINGTON. Vol. II. London: Macmillan & Co. Price $1.75.

These South Kensington lectures set forth in fairly non-technical style the latest results in several departments of science, as understood by English scientists of high rank. The subjects treated are: Polarized Light, by W. Spottiswoode; Thermal Conductivity, Thermodynamics, and the Velocity of Light, by Professor Forbes; Balances, by H. W. Chisholm; Geometrical and Engineering Drawing, and Light House Illumination, by Professor T. F. Pigot; The Laws of Fluid Resistance, by W. Froude; The Bathometer, by Dr. Siemens; Instruments for Experiments on Sound and Temperament, evidently by Dr. W. H. Stone, though no name is given; Sensitive Flames as Illustrative of Sympathetic Vibration, by Professor Barrett; Apparatus for Physiological Investigation and for Physiological Chemistry, by Drs. Burden Sanderson and Lauder Brunton; On Eudiometers, by Professor McLeod; and Technical Chemistry, by Professor Roscoe.

ELEMENTARY LESSONS ON SOUND. By Dr. W. H. Stone. London: Macmillan & Co. cloth, pp. 191. Price 80 cents.

As an elementary text book this work of Dr. Stone's presents several admirable features. It is well digested, compact, and better illustrated than works of the size are apt to be. The frequent summaries of facts and principles are tersely expressed and serviceable. And the book is well indexed. As a whole the work is peculiar in the fullness of the information given in the neglected field lying between acoustics and music—neglected, that is, in ordinary text books. The marked deficiency of the book is in respect to the more recent developments and applications of sound in connection with the phonograph, the telephone, the microphone, and the like. Though imprinted 1879, there is little to indicate that it was not written more than a twelvemonth earlier.

COMMERCIAL ORGANIC ANALYSIS. By Alfred H. Allen, F. C. S. Vol. I. Cyanogen Compounds, Alcohols and their Derivatives, Phenols, Acids, etc. London: J. & A. Churchill.

The first volume of a practical work which has no rival in English. Its scope is aptly described in the subtitle: A treatise on the properties, proximate analytical examination, and modes of assaying the various organic chemicals and preparations employed in the arts, manufactures, medicine, etc., with concise methods for the detection and determination of their impurities, adulterations, and products of decomposition. Mr. Allen appears to be competent to the task he has undertaken, and claims to have tested in his own professional experience the correctness of the methods given. The book is well made and printed in good type.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) P. M. asks: 1. Is zinc a mineral or compound metal, and where found? A. Zinc is a metal, seldom found pure. The existence of native zinc seems still to need confirmation. The chief ores are the silicate and oxide. The largest mines of this metal in the United States are in Sussex county, New Jersey. 2. Is tin a mineral or compound metal, and where found? A. Tin is a metal; reported as occurring with the Liberian gold; also in the Rio Tipuani valley, in Bolivia, but probably only an artificial product. (D. Forbes, *Phil. Mag.*, iv., xxix. 153, xxx. 142.) The principal ore of this metal is cassiterite or tinstone, found largely in Cornwall, England—not in this country. 3 What are brass and pewter composed of? A. Brass is an alloy of copper and zinc. Pewter is an alloy of tin and lead, common, 82 tin to 18 lead; fine, 5 tin to 1 of lead.

(2) H. L. V. N. writes: In connection with the "new optical delusion" in the SCIENTIFIC AMERICAN, for August 9, and explanations of same in August 30, I would call attention to one of a similar character, and very, almost unpleasantly, common occurrence. If a person looks intently at a swiftly moving body, such as a train of cars, near by, and then looks at a stationary body, as the ground, the whole surface of the stationary body will appear to move around several axes with a peculiar compound sinuous motion.

(3) E. H. asks if anything has been discovered which will remove freckles, either instantaneously or by repeated applications? A. A solution of corrosive sublimate, either pure or mixed with cyanide of mercury, is commonly employed for the removal of freckles; but a collodion, containing ten per cent of its weight of sulpho-carbolate of zinc, has given excellent results without being accompanied by any of the dangers attending the use of the mercurial solution. The following formula is an excellent one: Sulpho-carbolate of zinc, 1 part; collodion, 45 parts; oil of lemon, 1 part; absolute alcohol, 5 parts. Consult your physician in regard to application.

(4) G. P. A. asks: 1. Will ordinary clay, such as is used for flower pots, answer for the porous cells of a galvanic battery? A. If well burned, yes. 2. How may commercial zinc be purified for use in a battery? A. Pure zinc is prepared by distilling a mixture of zinc oxide and charcoal. The oxide must be purified by solution in an acid, and precipitation therefrom by a dilute alkali. See Wagner's Chemical Technology. New Jersey zinc is pure enough for ordinary battery purposes.

(5) J. R. H. asks: 1. Do gum belts require any dressing? A. No. 2. What kind of couplings are the safest and most durable for main shafts where belts run in all directions from it? A. Flange couplings and bolts. 3. Can dust from emery belts used for polishing wood be removed from each belt and the room as it is made: if so, by what means? A. Yes, by the use of an exhaust fan. 4. Is there any known composition or paint which, if applied to tin valleys and roofs, will prevent leaking? A. Some of the so-called India rubber paints may answer.

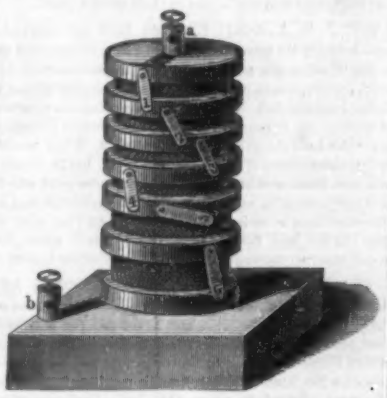
(6) C. C. asks (1) how to find the horse power of an engine. A. See p. 207 (4), Vol. 40, of the SCIENTIFIC AMERICAN. 2. What is the difference between a high and low pressure boiler; please explain and oblige? A. There are certain forms of boilers which are designated in the trade as low pressure or high pressure, but any form of boiler can be used as a low or a high pressure boiler, if it have strength proportionate to the pressure of steam to be carried.

(7) C. G. & Co. ask: Will a band saw run on wooden pulleys for sawing oak plank 2 inches thick or for sawing wagon fellies? A. The pulleys would answer for a time, but the wood would shrink and swell under the influence of the weather, and give constant trouble.

(8) H. M. D. writes: To ascertain the amount of power it takes to drive a certain number of machines, can it not be done by putting them all at work at their full capacity and then throw off the main belt, leaving them all ready to start to work as soon as there is power enough applied, then take a cord or belt, and make one end fast to one arm of the main pulley and throw the other over on the outside and wind around, then hang on weights enough, on the lower end of the cord to start the machinery at its usual speed, then weigh the weights? It seems to me that the above method is a correct one to ascertain the correct amount of power used. A. If you can accomplish it as you propose, it will give you the amount of power; but we think you will find it a difficult thing to do.

(9) B. B. M. asks (1) for a receipt for making mustard for table use. A. 1. Salt, 1½ lb.; scraped horse radish, 1 lb.; garlic, 2 oz.; cloves, 2 oz.; hot vinegar, 2 gallons; macerate in a covered vessel 24 hours, strain and add flour of mustard, *q. s.* 2. Mustard, 3 lb.; salt, 1 lb.; vinegar, grape juice, or white wine, to mix. 2. What is the rule for getting the weight of hay in bulk as in a mow? A. A solid cube of dry hay, 10 feet square, weighs about one ton.

(10) A. R. M. asks how to make a cheap rheostat. A. Eisenlohr's column of resistance, shown in the accompanying cut, is inexpensive and very convenient. It consists of a cylinder of mahogany or other compact wood, having about nine grooves cut in it. The cylinder is saturated with paraffine or varnished with shellac, and the spaces between the grooves are bound with brass bands. A little brass bar, turning on a screw, is made to extend from one ring to the other, as shown; these bars must be slightly bent so as to press



with some force upon the bands. Covered wire of a known resistance is wound in these grooves, the shortest length containing the given unit once or an even number of times. The length of the coils of wire in the successive grooves increases from 1 to 9; the ends of each wire are soldered to the two nearest bands, the upper band being connected with the screw, *a*, and the lowest with *b*. When this column is inserted in a circuit, the current passes from one ring to another through the bars, whose resistance is inconsiderable, but when one of the bars is turned aside, as shown in the engraving, the current passes through the intervening coil.

(11) W. W. M. asks: Where can manganese in the metallic state be obtained; can it be melted in a plumbago crucible, either by itself or in molten copper? A. Metallic manganese is not a commercial article, but small quantities of it may be purchased from dealers in rare chemicals, etc., at $1 per gramme. In appearance it somewhat resembles iron, but is usually much harder, and requires a very strong white heat to effect its fusion. In small quantities the metal will alloy with copper at a high temperature, if protected from the air by powdered carbon. 2. I obtained some

of the ore in a comminuted state, and was told that it could not be melted. I put some of it, with some borax for a flux, in an anthracite coal furnace, and obtained something like the inclosed sample. Is it of any value? A. The sample probably consists of the double borate of manganese and sodium, used in Germany as a substitute for litharge in the manufacture of paint driers, japans, etc. It would hardly command a remunerative return here.

(12) W. C. B. asks: How much more (if any) than its own weight, can a railroad engine start on a perfectly level track, assuming that there is no slack between the engine and cars? A. It depends upon the style and proportions of the locomotive, number of drivers and diameter, proportion of weight on drivers, and steam carried, also the style of the cars in the train.

(13) J. W. M. asks: How many feet should the piston head of a steam engine travel per minute? A. There is no fixed rule for the speed; it depends upon the length of stroke and the work that is to be driven, in other words, the speed of the piston is adapted to the work to which the engine is applied.

(14) C. E. B. writes: I am running an engine in a saw mill, driving wheel 20 feet, drum on saw shaft 2 feet, engine makes about 75 revolutions per minute. Can I increase the capacity for work by double gearing: if so, I would like to reduce the driving wheel to 16 feet? A. No, it would be better, if you wish to reduce the pulley to 16 feet, to increase the speed of the engine proportionately.

(15) L. M. D. asks: 1. What is the best way to pack the screw shaft of a toy propeller? A. Pack with cotton wicking. 2. What should be the dimensions of cylinder for running the boat, which is two and a half feet long? A. From 1 inch to 1¼ inch diameter, and 2 inch to 2¼ inch stroke. 3. What is the best shape of boiler? A. A vertical tubular.

(16) J. C. M. asks: 1. In a flour bolt is it usual to put on two widths of bolting cloth; what would be the objection to putting on three? A. Two, three, or four are used; it is common to put on three; it depends upon the number of grades you wish to turn out. 2. I have built my dam V shaped, sharp part down stream; would that shape cause the water to rise less on the abutments? A. In strong currents there will be less rise on the shore abutments. 3. At what speed should an overshot water-wheel run? A. 4 to 8 feet per second. 4. Can a horse pull as much 500 feet from his load (on a level with his shoulders) as if within 5 feet? A. Yes, all other things being equal; but if there is 500 feet of rope dragging on the ground, its friction is a part of the load.

(17) W. N. R. writes: In a late number, p. 267, SCIENTIFIC AMERICAN, you gave a simple method of finding pressure in steam boiler with weight at a certain point on lever. Now, will you please give as simple a method of finding the point at which to place the weight so that steam will blow off at any required pressure? A. 1st, Multiply the pressure per square inch by the area of the valve; the product is the total weight required upon the valve. 2d, Divide this total pressure by the weight to be hung on the valve lever; the quotient is the number of "leverages" which you must give the weight from the fulcrum. Suppose 100 lb. steam and 12 inches area of valve: then total pressure on the valve is 1,200 lb.; and if the weight be 80 lb., then 1200÷80=15 "leverages." Now, if the distance from fulcrum to center of valve be 3 inches, then the weight must be set at 3x15=45 inches from fulcrum, or 42 inches from center of valve. Of course this does not take into account the effect of the lever or weight of the valve.

(18) E. F. W. asks: Can you inform me of a place where engineering ability is appreciated and paid for, and where men are obliged to be engineers who have charge of engines? A. We know of no such paradise. The ability of a competent engineer is not appreciated. So long as men will employ any one at low wages who can stop and start an engine, so long real engineers will not be put in their proper place.

(19) J. S. A. asks: 1. How fast an engine, with cylinder 3¼ inch diameter and 3 inch stroke, and 80 or 100 lb. of steam, and connected with paddle shaft by gears (bevel), would propel a flat-bottomed skiff 15 feet 6 inches long and 30·5 inches wide, and drawing 5 or 6 inches of water? A. If geared 9 or 4 to one, would probably drive the boat about 5 miles per hour. 2. What would be the dimensions of the boiler to supply 100 lb. steam, and how thick should the iron or steel plates be of which it is constructed to safely withstand the pressure and at the same time be as light as possible? A. The size of your boiler and thickness of iron depend upon the speed you run the engine and the design of the boiler.

(20) M. B. writes: We have placed a hydraulic ram to force water to the barn, a distance of 1,500 feet, and 40 feet rise and 2 feet fall for a 2 inch feed pipe 40 feet long. We had at first a No. 4 ram, which furnished but a ¼ inch stream, and have now placed a No. 5 ram, which will not strengthen the stream. We were advised to place a ¾ inch discharge pipe, which we did. I would like to know if it would not throw a stronger stream with ¼ inch pipe, and work more freely. A. According to the tables the ram should have 1 inch pipe instead of ¼ inch. Apply to the maker of the ram for advice. 2. How much water is contained in the air chamber? A. The quantity of water in the air chamber will depend upon the pressure under which the water is delivered.

(21) J. N. T. asks: What is a suitable size of engine for a boat 35 to 40 feet long and 8 feet beam? A. A high pressure engine of 8 inch cylinder and 9 or 10 inches stroke will give your boat good speed.

(22) B. T. L. asks: 1. Supposing a horse attached to an empty wagon runs rapidly around a sharp curve, which wheels of the wagon bear hardest on the ground? Or, in other words, if the velocity be sufficient to raise any of the wheels from the ground, from natural causes which will be raised, the inner or the outer wheels? A. Inside wheels. 2. If a man be in a wagon rapidly turning a curve, will he, to preserve his balance, instinctively lean toward the outer or inner edge of the curve? A. Toward the inner side of curve. 3. Why, on railroad curves, is the outer rail raised several inches above the inner? A. To counteract the effect of centrifugal force in running the curve.

(23) C. R. J. asks: Will black lead do for a substitute for gas coke in batteries? A. Yes, Professor Silliman, Jr., used it in the Grove form of battery as a substitute for platinum, in 1842. Gas carbon is found to answer a better purpose.

(24) L. H. H. asks: 1. Does a low pressure engine gain power by condensing its steam? A. Yes, the gain is considerable. 2. Are high pressure engines made with walking beams? A. Yes, in great numbers.

(25) "Tropic" asks if there are furnaces made to burn petroleum oils (that could be used instead of coal or wood in hot climates) sufficient to heat a large-sized fruit evaporator continuously, and where such can be got. A. There are several petroleum furnaces now in the market, one of which would doubtless answer your purpose. See "Business and Personal" column. 2. Can you inform me if any material can be had that would absorb the moisture from the saturated air in a large sized drier so that the heat may be confined and yet the water or vapor disposed of? A. We know of nothing likely to be if any practical service in this connection. 3. Do you know of any of the refiners of petroleum oils do or will prepare the "petroleum jelly" made with digested soap wort and refined kerosene oil? A. "Petroleum jelly," or vaseline, is manufactured on a large scale. It is a proprietary article.

(26) T. F. writes: We have a natural supply of water at an elevation of about 100 feet and 1,500 feet distant from the center of our village, and we propose bringing the water down in pipes for the purpose of extinguishing fires. The main pipe will enter the main street at right angles, and a branch run not to exceed half a mile, and, as it is not probable that we can have hydrants near enough together, or have hose enough to bring more than two streams of water to bear upon one building, now what size should main pipe and branches be, or rather, what is the smallest size that can be used and make it effectual, and of what size should the hose and the discharge nozzles be? A. The larger the pipes the less the loss of head by friction. We think the main pipe should not be less than 6 inches, and the branch pipes, 4 inches diameter.

(27) A. W. S. asks what is put upon microscopes to keep them from tarnishing. I have just made one and wish to know what lacquer to put on it. A. A thin coating of fine alcoholic shellac varnish applied to the work, which has been previously warmed, will preserve the color of the brass. The color of the lacquer may be heightened by adding turmeric or dragon's blood, or both. 2. How can I resilver or recoat the back of a concave mirror or reflector for microscope? A. See article on silvering glass in SUPPLEMENT, No. 105. 3. I am a brass finisher by trade, and would like very much to know how yellow brass may be made to keep its color without appearing varnished. A. A thin varnish of white shellac or a coating of collodion will do this. It will retain its color for a long time without a protective coating of any kind, if the finish is sufficiently fine. A light film of gold is the best possible coating for fine brass work.

(28) D. J. T. O. asks for a good receipt for making wine for home use out of our common grapes. A. Put 20 lb. of ripe, fresh picked, and well selected grapes into a stone jar, and pour on them 6 quarts of boiling water. When the water has cooled enough, squeeze the grapes well with the hand; cover the jar with a cloth, and let it stand for three days; then press out the juice, and add ten pounds of crushed sugar. After it has stood for a week, scum, strain, and bottle it, corking loosely. When the fermentation is complete, strain it again and bottle it, corking tightly. Lay the bottles on their side in a cool place.

(29) J. S. writes: 1. I propose making an electric motor, and would like to use in its construction the Camacho electro magnet, as illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 182, page 2,900. Is the yoke made of iron or wood? A. Iron. 2. If of iron, would pieces of ordinary gas pipe, soldered to the yoke, do for the tubes? A. Gas pipe will do, but it must not be soldered. The iron of the yoke must make a good contact with the iron of the tubes. 3. Would ¾ inch (outside diameter) gas pipe be too large for first, or inside tube? A. It would be better to use a smaller size, say ½ inch. 4. Must the inside of each outer tube press tightly against the insulated wire of each inner tube? A. It need not necessarily press tightly, but the space between the two should be small. 5. The battery will be close to the magnets: will No. 16 cotton covered wire be suitable? A. Yes. 6. I propose making the cores five inches long, and use three or four thick tubes: how thick should the yoke be? A. ½ inch. 7. If four tubes are used in each core, about what attractive force would such a magnet exert, at a distance of ½ of an inch, with a battery of 12 elements (large size), such as is illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 149, page 2363? A. It would be difficult to estimate the attractive force of such a magnet without knowing more of its construction and the circumstances under which it is used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. A. B.—No. 1. Limonite, a very fine iron ore. No. 2. Clay, aluminum silicate, containing much silica. If properly washed, of some value for the production of cheap pottery ware. No. 11. Hematite, an iron ore of good quality. No. 12. Chiefly iron pyrites, sulphide of iron. No. 10. Partially altered calcium carbonate, calc spar, containing traces of strontium carbonate and manganese oxide. No. 8. Ferruginous limestone. The other specimens are limestones. No. 6 will probably yield the best lime.—J. M. G.—It is a syenitic gneiss rock of little value.

COMMUNICATIONS RECEIVED.

On Boiler Explosions. By R. H. B.
Plan for the Darien Canal. By C. A.
On Fire Alarms and Fire Escapes. By W. A.
A Positive Discovery. By T. B. M.
On the Holloway Process. By L. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 19, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Bale tie, D. D. Cohen 218,712, 218,713
Bale tie, C. W. Shepard 218,734
Bale ties, device for applying, C. P. Higgins 218,740
Bale tying machine, C. P. Higgins 218,741
Baling press registering device, B. Smith 218,645
Barrel cleanser and washer, C. Gilsmann 218,621
Bed bottom, J. P. Radley 218,686
Bed, cabinet, F. Koskul 218,672
Bird cage, J. Maxheimer 218,758
Bolt trimmer, W. Butler 218,706
Boot and shoe counter stiffeners, machine for moulding and shaping, G. F. Moore 218,763
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Brow band, R. Manning 218,755
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Cars, heating and ventilating, W. E. Prall 218,685
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Fire back, W. T. Bradberry 218,616
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Propeller, vibrating, J. L. Nevers 218,766
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Pulley crane for clothes lines, Haisbeck & Green 218,773
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Windmill, L. C. Coriell 218,715
Window frame machine, W. H. H. Kesler 218,751
Window ventilator, J. E. Lloyd 218,754
Wood, process and apparatus for preserving and curing, W. D. Grimshaw 218,624

TRADE MARKS.

Beefsteak tenderer, F. E. Clark 7,897
Calf skins and kips, Loeb & Brothers 7,903
Cigars, cigarettes, plug, and fine cut chewing and smoking tobacco and snuff, Doban, Carroll & Co. 7,894
Cut smoking tobacco, H. Mandelbaum 7,900
Diaries, J. Gladding & Son 7,896
Dress shirts, cotton and woolen shirts, undershirts, and collars, H. Wallach's Sons 7,908
Flour, T. J. Cox 7,901
Kid and lamb skin gloves, G. Cramer 7,902
Medicinal preparation, J. B. & E. A. Griffith 7,893
Preparation for the toilet, H. C. Parker 7,900
Sewing machine, St. John Sewing Machine Co. 7,907
Smoking tobacco and cigarettes, J. R. Day & Bro. 7,898
Starch for laundry use, Glen Cove Starch M'f'g Co. 7,905
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Carpet, E. Fisher ..... 11,341 to 11,352
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English Patents Issued to Americans.

From August 8 to August 12, inclusive.

Barbed fence wire, manufacture of, A. Cary, N. Y. city.
Bed bottoms, C. D. Flynt, Brooklyn, N. Y.
Boiler flue, regulating draught in, A. C. Harrison, Philadelphia, Pa.
Burnishing screw heads, machinery for, C. D. Rogers, Providence, R. I.
Carding engines, J. Abbott, Philadelphia, Pa.
Clasps, B. Greig, New York city.
Deaf, instrument for, R. S. Rhodes, Chicago, Ill.
Glazed surface, treatment of, W. Gibson, N. Y. city.
Governor, automatic for marine engines, C. W. Cooper, New York city.
Grinding machine for cards of carding engines, B. S. Roy, Worcester, Mass.
Motors, Molera & Cebrian, San Francisco, Cal.
Plaster and pad therapeutic, R. M. Kennedy, Pittsburg, Pa.
Sewing machine, carpet, J. Hess, San Francisco, Cal.
Ventilating buildings, apparatus for, F. L. Norton, New York city.
Veneer cutting machine, H. T. Bartlett, New York city.
Window cleaning chair, Anna Dornitzer, N. Y. city.

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THE STUDY AND CONSTRUCTION OF TOOTHED GEAR.—Involute, cycloid, and epicycloid. Involute, Cycloid. External, epicycloid, described by a circle rolling about a fixed circle inside of it. Internal epicycloid. Delineation of a rack and pinion in gear. Gearing of a worm with a worm wheel. Cylindrical or Spur Gearing. Practical delineation of a couple of Spur wheels. The Delineation and Construction of Wooden Patterns for Toothed Wheels. Rules and Practical Data.

CONTINUATION OF THE STUDY OF TOOTHED GEAR.—Design for a pair of bevel wheels in gear. Construction of wooden patterns for a pair of bevel wheels. Involute and Helical Teeth. Contrivances for obtaining differential Movements. Rules and Practical Data.

ELEMENTARY PRINCIPLES OF SHADOWS.—Shadows of Prisms, Pyramids, and Cylinders. Principles of Shading. Continuation of the Study of Shadows. Tuscan Order. Rules and practical data.

APPLICATION OF SHADOWS TO TOOTHED GEAR.—Application of Shadows to Screws. Application of Shadow to a Boiler and its Furnace. Shading in Black—Shading in Colors.

THE CUTTING AND SHAPING OF MASONRY.—Rules and Practical Data. Remarks on Machine Tools.

THE STUDY OF MACHINERY AND SKETCHING.—Various applications and combinations: The Sketching of Machinery. Drilling Machines; Motive Machines; Water wheels. Construction and Setting up of water wheels. Delineation of water wheels, Design of a water wheel. Sketch of a water wheel. Overshot water wheels. Water Pumps; Steam Motors; High-pressure expansive steam engine. Details of Construction; Movements of the Distribution and Expansion Valves; Rules and Practical Data.

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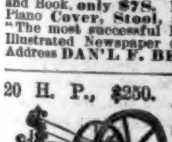

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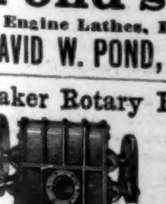

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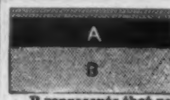

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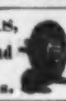

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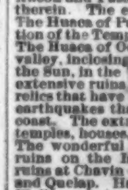

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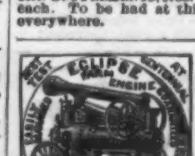

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